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ORIGINAL ARTICLE

High-flow nasal cannula effectiveness in acute bronchiolitis: a retrospective study

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Abstract

Introduction and Objectives: Acute bronchiolitis (AB) is a leading cause of hospital admission in pediatric patients. The main objective of this study was to evaluate the effectiveness of high-flow nasal cannula (HFNC) oxygen therapy in AB. **Methods:** Retrospective cohort study. Patients (1–24 months of age) admitted with AB in a tertiary hospital were included, comparing the periods before ('preHFNC: Apr/2018–Nov/2019) and after the introduction of HFNC ('postHFNC: Nov/2019–Apr/2022). The outcome measure of effectiveness was transfer to the intensive care unit (ICU). Effect measures were relative risk (RR), absolute risk reduction (RRA) and number needed to treat (NNT). **Results:** Of the 486 patients included, 196 were preHFNC and 290 were postHFNC. Of the latter, 46 (14.9%) required HFNC. Treatment with HFNC was associated with a significant reduction ($p < 0.001$) in respiratory rate, use of accessory muscles, wheezing and, consequently, an improvement in the WARM score. In the postHFNC period, there were fewer transfers to the ICU (21.4% vs. 13.8%, $p = 0.027$), with RR = 0.66, RRA = 7.6% and NNT = 13. In patients treated with HFNC, daycare attendance ($p = 0.036$; OR 91.7) and a higher WARM score 24 hours after HFNC ($p = 0.009$; OR 16.2) were predictors of transfer to the ICU (Hosmer-Lemeshow: $x 2 = 0.82$, $p = 0.976$). In the survival curve for time to ICU admission, preHFNC patients were transferred earlier ($p = 0.013$). None of the patients under HFNC required invasive ventilation. **Discussion:** The introduction of HFNC in the treatment of AB reduced the need for the ICU and was associated with a clinical improvement in several respiratory parameters. On the basis of the NNT, it is estimated that three to four ICU admissions were avoided in the postHFNC period.

Keywords: Pediatric respiratory care. Intensive care unit. Invasive ventilation. Respiratory rate. Respiratory distress.

Efetividade da oxigenoterapia de alto fluxo na bronquiolite aguda: estudo retrospetivo

Resumo

Introdução e Objetivos: A bronquiolite aguda (BA) é das principais causas de internamento em idade pediátrica. O principal objetivo deste estudo foi avaliar a efetividade da oxigenoterapia por cânulas nasais de alto fluxo (CNAF) nestes doentes. **Métodos:** Estudo de coorte retrospetivo. Incluídos doentes (1–24 meses) internados com BA num hospital terciário, comparando os períodos antes ('pré-CNAF':Abril/2018–Novembro/2019) e após introdução de CNAF ('pós-CNAF':Novembro/2019-Abril/2022). A medida de efetividade foi a transferência para cuidados intensivos (UCI). As medidas de efeito foram:

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risco relativo (RR), redução risco absoluto (RRA) e número necessário para tratar (NNT). **Resultados:** Incluídos 486 doentes, 196 pré-CNAF e 290 pós-CNAF. Destes últimos, 46 (14.9%) necessitaram de CNAF. O tratamento com CNAF associou-se a uma redução significativa (p < 0,001) na frequência respiratória, uso de músculos acessórios, pieira, alterações dos sons pulmonares e, consecutivamente, melhoria no score de Warm. No pós-CNAF verificaram-se menos transferências para UCI (21,4% vs 13,8%, p = 0,027), com RR = 0,66, RA = 7,2% eNNT = 13. Nos doentes sob CNAF, a frequência de infantário (p = 0,036; OR 91.7) e maior score de Warm às 24 h CNAF (p = 0,009; OR 16.2) foram preditores de transferência para UCI (Hosmer-Lemeshow: x2 = 0,82, p = 0,976). Na curva de sobrevivência para o tempo até admissão na UCI, os doentes pré-CNAF foram transferidos mais precocemente (p = 0,013). Nenhum dos doentes sob CNAF necessitou de ventilação invasiva. **Discussão:** A introdução de CNAF no tratamento da bronquiolite aguda reduziu a necessidade de UCI, associando-se a uma melhoria clínica em diversos parâmetros respiratórios. De acordo com o NNT, estima-se que tenham sido evitados 3–4 internamentos em UCI no pós-CNAF.

Palavras-chave: Cuidados respiratórios pediátricos. Unidade cuidados intensivos. Ventilação invasiva e não invasiva. Frequência respiratória. Dificuldade respiratória.

Keypoints

What is known
- Current guidelines suggest only supportive therapy, such as oxygen therapy, respiratory support and maintaining hydration for AB treatment.
- HFNC therapy has emerged as a new method of respiratory support, due to its good tolerability and safety.
- Studies suggest that HFNC can decrease the work of breathing, the need for intubation and prevent ICU admission, although the evidence is still limited.

What is added
- In our cohort, the introduction of HFNC in the treatment of AB reduced the need for ICU admission.
- The use of HFNC was associated with a clinical improvement in several respiratory parameters.
- It is estimated that three to four ICU admissions were avoided in the postHFNC period.

Introduction

Acute bronchiolitis (AB), a lower respiratory tract infection that is generally caused by respiratory viruses, is one of the leading causes of hospital admission in pediatric patients. Although most cases are self-limiting, between one and 5% will need hospital admission[1], and up to 23.8% of these patients will require critical care due to respiratory impairment or apnea[2]. Respiratory syncytial virus (RSV) is the most common virus identified (63.5%), but coinfection may be present in 35.5% patients[3]. Prematurity and preexisting comorbidities, such as heart disease, chronic respiratory disease, neuromuscular disease or immunodeficiencies were identified as risk factors for severe disease[4]. Various medical therapies have been investigated in patients with bronchio-litis, but none of them have shown efficacy[5]. Current guidelines suggest only supportive therapy, such as oxygen therapy, respiratory support and maintaining hydration[1]. For years, mild AB was limited to noninvasive oxygen therapy with low-flow nasal cannula. Patients with severe dis-ease required noninvasive ventilation (NIV) or invasive mechanical ventilation (IMV)[6]. High-flow oxygen therapy through a nasal cannula (HFNC) has emerged as a new method of supportive treatment with the administration of warm, humidified airflow, with or without oxygen, due to its simplicity, good tolerability and safety[6]. Some studies suggest that HFNC could decrease the work of breathing[7], the need for intubation[8] and prevent high-cost intensive care[9]. However, more recent studies have shown that HFNC may not be as superior compared to single oxygen therapy (SOT)[10]. So, the evidence on its effectiveness and specific indications in AB is still limited. The aim of this study was to evaluate the effectiveness of HFNC in AB treatment by assessing the proportion of intensive care (ICU) admission. We also analyzed the changes in work of breathing and differences in the timing of ICU admission in patients on HFNC. Predictive factors for the need for HFNC and HFNC failure were evaluated.

Materials and methods

Study design, setting and participants

We conducted a retrospective cohort study including patients aged under 24 months with a diagnosis of AB that required hospital admis-sion at our tertiary hospital, Centro Materno-Infantil do Norte, Centro Hospitalar

Universitário do Porto, between April 2018 and March 2022, inclusive. Patients with incomplete electronic medical records, neuromuscular diseases and pulmonary chronic diseases under home oxygen therapy were excluded.

In November 2019, HFNC was introduced in our hospital, with the AIRVO2 Fisher&Paykel® systems. It was started in the pediatric wards following a clinical protocol based on different pediatric societies' recommendations. Study data was collected between September and December 2022.

This study has been reviewed and approved by the Ethics Committee of Centro Hospitalar Universitário do Porto (2022.124(097-DEFI/099-CE). This manuscript followed STROBE (Strengthening the Reporting of Observational studies in Epidemiology) guidelines[11].

Variables

AB diagnosis was defined according to national guidelines criteria[12]. Two groups were made, based on the availability of HFNC. The 'preHFNC' group included the participants admitted before HFNC was available at our hospital [April 2018 – October 2019] and the 'postHFNC' group included participants admitted after HFNC was available [November 2019 – March 2022].

The main outcome measure of HFNC effec- tiveness was admission to the ICU. Secondary outcomes were differences in the timing of ICU admission in patients on HFNC and changes in the work of breathing after starting HFNC.

Data collection

All the data were extracted from the elec- tronic medical records: date of admission, date of discharge, date of birth, age, sex, weight on admission, prematurity, need for respiratory support in the neonatal period, preexisting comorbidities (pulmonary, cardiac, neurologic, immunodeficiency or chromosomal disorders), personal or family history of allergies, exposure to tobacco smoke, daycare attendance, day of illness on admission, clinical presentation on admission (fever, cough, dyspnea, rhinorrhea, vomiting, diarrhea, respiratory rate, oxygen sat- uration, work of breathing and pulmonary auscultation), viral identification in nasopharyngeal aspirate, antibiotic therapy, HFNC use, admission to the ICU, blood gas analysis, ICU length of stay, NIV and IMV. In patients on HFNC we also recor- ded: respiratory rate and work of breathing immediately before and 24 hours after initiating HFNC.

The WARM score was calculated for each participant on admission, and immediately before and 24 hours after initiating HFNC[13].

Statistical methods

We performed statistical analysis using SPSS® version 27 (SPSS IBM, New York, NY, USA). Descriptive statistics are presented as means (M) and standard deviations (SD) for quantitative and symmetrically distributed variables; medians (Mdn) and interquartile ranges (IQR) are presented for quantitative and non-symmetrically distributed variables. Frequencies (n) and proportions (%) are presented for qualitative variables. Normality was assessed using the Shapiro-Wilk test and histogram observation. T-tests were used to compare quantitative variables after checking for homogeneity of variance using Levene's test. When the normality assumption was not met, the Mann-Whitney U test was used. Chi-square tests were used to compare proportions across qualitative variables. The Cochran-Mantel-Haenszel test was used to control the effects of a third variable when evaluating the association between qualitative variables. Fisher's exact test was used when the expected frequency was lower than five in more than 20% of the contingency table cel/mm. Logistic regression was used to measure the association between the dependent variable (HFNC use and failure) and a set of independent variables. The Hosmer-Lemeshow test ($p > 0.05$) assessed the quality of adjusting binomial data to a logistic model-type. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated.

The impact of introducing HFNC was assessed by using the following effect measures: relative risk (RR), absolute risk reduction (ARR) and the number needed to treat (NNT). We analyzed the changes in quantitative secondary outcome variables (WARM score and respiratory rate) by using the Mann-Whitney U for paired samples. Qual- itative variables (work of breathing and pulmonary sounds) were compared using the Marginal Homogeneity test. We also conducted a survival analysis of the time to ICU admission by calculating adjusted hazard ratios by means of Cox regression. Statistical significance was set at $p < 0.05$. Missing data were omitted and the remaining data analyzed.

Results

There were 502 admissions with AB diagnosis in the study period. Sixteen patients were excluded: 10 with

incomplete data, four with neuro-muscular disease and two under home oxygen therapy (Fig. 1). Of the 486 patients included in the study, 196 were in the preHFNC cohort and 290 in the postHFNC cohort (Table 1). There were no demographic and *a priori* clinical statistical differences between the periods. In the postHFNC group, 46 patients (14.9%) received respiratory support with HFNC.

Comparison of preHFNC vs. postHFNC

There was a significant reduction in the number of ICU admissions in the postHFNC group (21.4% vs. 13.8%, p = 0.027), corresponding to a RR of 0.66 (CI 0.43–0.95), ARR of 7.6% (0.65–14.61) and NNT of 13 (6.84–153.08). There were no significant differences in the respiratory support techniques used in each group, but there was a trend towards a reduction in the need for NIV (17.3% vs. 12.5%) and for IMV (2.6% vs. 2.0%). No differences in overall or ICU length of stay were found between the groups. On the survival analysis, patients that needed ICU admission were transferred earlier in the preHFNC group (mean 0.3 vs. 0.8 days; p = 0.013; Fig. 2).

PostHFNC period analysis

In the postHFNC period, there were no age, gender or preexisting comorbidity differences between patients that received HFNC and those who did not (Table 2). However, patients that needed HFNC were admitted earlier in the course of their disease (median days of illness on admission: 2.8 vs. 4.3; p < 0.001) and had a higher WARM score on admission (median 2.3 vs. 1.7; p < 0.001). Enterovirus and bocavirus were more frequent in the HFNC group (7.8% vs. 3.6%, p < 0.001; 11.1% vs. 2.6%, p = 0.015, respectively).

In the multivariate analysis, exploring predictive factors for the need for HFNC in the postHFNC period, the identification of enterovirus (OR 9.30; 95% – CI 2.90 29.80; p < 0.001), an earlier day of illness on admission (p = 0.005; 95% CI 0.62–0.92; OR 0.76) and a higher WARM score (p = 0.004; 95% CI 1.14–1.96; OR 1.5) were found to predict a higher probability of HFNC use (Hosmer-Lemeshow test: x^2 = 4.7, p = 0.698). Within the participants that used HFNC, there was a significant decrease in respiratory rate (from 57.2 ± 10.3 to 46.3 ± 8.9; p < 0.001) and in the WARM score (from 4.98 ± 0.65 to 2.31 ± 1.18; p < 0.001) 24 hours after initiating HFNC. There was also a significant reduction in muscle use, wheezing and increase in air exchange (p < 0.001). None of the participants on HFNC needed IMV and 10 (21.7%) needed NIV. However, out of those in the nonHFNC group, 26 needed NIV (10.7%; p = 0.038) and six (2.5%; p = 0.282) needed IMV. However, the higher prevalence of NIV in the HFNC group was mediated by a higher severity on admission. After adjusting for the WARM score, there was no statistical difference (p = 0.632).

In the multivariate analysis, HFNC failure (i.e., the need for ICU admission) was associated with daycare attendance (OR 91.7; 95% CI 1.34–6.28; p = 0.036) and a higher WARM score 24 hours after initiating HFNC (OR 16.2; 95% CI 2.01–130.80; p = 0.009), Hosmer-Lemeshow: x^2 = 0.82, p = 0.976.

Discussion

In our study, we found that significantly fewer patients needed ICU admission after the introduction of HFNC in our hospital. We also found a NNT of 13, which means that we may have avoided three to four ICU admissions between November 2019 and April 2022 (postHFNC period). Interestingly, there was a trend towards a reduction in the proportion of patients that needed NIV.

Several studies reported the same rates of ICU admission regardless of the use of HFNC[8,9]. However, Kepreotes et al. demonstrated that HFNC may have a role as a rescue therapy to reduce the proportion of children requiring high-cost ICU care[9].

Also, according to Kepreotes et al. and Franklin et al., there were no differences in overall length of stay or ICU length of stay between the groups[9,14].

When looking at predictive factors for HFNC use, we found that an earlier day of illness on admission, a higher WARM score and the identification of enterovirus were significantly associated with HFNC use. Caliskan et al. also found that a shorter duration between the onset of symptoms and admission is an independent parameter for severe bronchiolitis development[15]. Parker et al. reported that patients with a higher accessory muscle use and tachypnea had a higher risk of needing major intervention[16]. In regard to enterovirus infections, Renois et al. and Asner et al. found a greater clinical severity in bronchiolitis with enterovirus infection[17,18].

In analyzing the response to HFNC oxygen therapy, we verified a significant decrease in respiratory rate, muscle use, wheezing, air exchange and consequently the WARM score. Overall, there was a significant decrease in the work of breathing, which is in line with the study conducted by Pham et al., where HFNC appeared to offload the diaphragm and reduce the work of breathing in bronchiolitis[7].

Table 1. Patients' characteristics by group

	Total sample	PreHFNC	PostHFNC	p
Participants, n	486	196	290	
Age in months, mean (SD)	5.7 (9.4)	5.18 (5.6)	6.05 (11.3)	0.316
Male, n (%)	266 (54.7)	110 (56.1)	156 (53.8)	0.613
Prematurity, n (%)	91 (18.7)	38 (19.5)	53 (18.3)	0.738
Neonatal respiratory support, n (%)	44 (9.1)	22 (11.3)	22 (7.6)	0.165
Preexisting comorbidities, n (%)				
Pulmonary disease	10 (2.1)	6 (3.1)	4 (1.4)	0.200
Cardiac disease	16 (3.3)	7 (3.6)	9 (3.1)	0.777
Immunodeficiency	2 (0.4)	2 (1.0)	0 (0.0)	0.085
Chromosomal disorders	4 (0.8)	2 (1.0)	2 (0.7)	0.692
Neurologic disease	14 (2.9)	6 (3.1)	8 (2.8)	0.845
Family history of allergies, n (%)	199 (41.5)	90 (46.6)	109 (38.0)	0.059
Personal history of allergies, n (%)	22 (4.6)	8 (4.1)	14 (4.9)	0.713
Exposure to tobacco smoke, n (%)	203 (42.5)	87 (45.3)	116 (40.6)	0.303
Daycare attendance, n (%)	98 (21.0)	43 (22.4)	55 (20.0)	0.532
Symptoms on admission, n (%)				
Fever	227 (46.7)	98 (50.0)	129 (44.5)	0.232
Cough	448 (92.2)	180 (91.8)	268 (92.4)	0.816
Dyspnea	271 (55.8)	106 (54.1)	165 (56.9)	0.540
Vomiting	61 (12.6)	18 (9.2)	43 (14.8)	0.065
Diarrhea	31 (6.4)	12 (6.1)	19 (6.6)	0.859
Physical examination on admission, n (%)				
Nasal flaring	46 (9.5)	24 (12.2)	23 (7.6)	0.085
Wheezing	31 (6.4)	16 (8.2)	15 (5.2)	0.186
Retractions, n (%)				0.078
Subcostal or intercostal	257 (53.0)	113 (57.7)	144 (49.8)	
Global	162 (33.4)	64 (32.7)	98 (33.9)	
Lung auscultation, n (%)				0.245
Decreased pulmonary sounds in one area	14 (2.9)	4 (2.0)	10 (3.4)	
Decreased pulmonary sounds in > one area	39 (8.0)	20 (10.2)	19 (6.6)	
Respiratory rate, mean (SD)	50.6 (12.1)	51.6 (12.8)	49.8 (11.7)	0.150
SpO_2, mean (SD)	93.6 (4.4)	93.17 (4.8)	93.8 (4.1)	0.100
Weight on admission in Kg, mean (SD)	6.2 (2.5)	5.9 (2.2)	6.3 (2.6)	0.082
Virus, n (%)				
RSV	299 (68.0)	109 (64.9)	190 (69.9)	0.278
Adenovirus	18 (4.2)	11 (6.8)	7 (2.6)	0.033
Metapneumovirus	32 (7.4)	15 (9.3)	17 (6.3)	0.247
Rhinovirus	86 (20.0)	38 (23.6)	48 (17.8)	0.143
Parainfluenza	24 (5.6)	12 (7.5)	12 (4.4)	0.177
Influenza	4 (0.9)	2 (1.2)	2 (0.7)	0.599
Enterovirus	22 (5.1)	6 (3.7)	16 (5.9)	0.312
Bocavirus	18 (4.2)	6 (3.7)	12 (4.4)	0.719
Coronavirus	6 (1.4)	4 (2.5)	2 (0.7)	0.135
SARS-CoV-2	3 (0.6)	---	3 (1.0)	---
Antibiotics use, n (%)	75 (15.5)	29 (14.8)	46 (15.9)	0.738
Respiratory support, n (%)				
None	98 (20.2)	46 (23.5)	52 (17.9)	0.135
SOT	388 (79.8)	150 (76.5)	238 (82.1)	0.135
HFNC	---	---	46 (15.9)	
NIV	70 (14.4)	34 (17.3)	36 (12.5)	0.133
IMV	11 (2.3)	5 (2.6)	6 (2.0)	0.726
ICU admission, n (%)	82 (16.9)	42 (21.4)	40 (13.8)	0.027
ICU length of stay in days, median (SD)	8.8 (4.7)	10.5 (5.9)	9.6 (2.9)	0.862
Overall length of stay in days, median (SD)	7.8 (22.4)	6.5 (4.3)	8.7 (28.8)	0.288

HFNC: high-flow nasal cannula; ICU: intensive care unit; IMV: invasive mechanical ventilation; NIV: non-invasive mechanical ventilation; RSV: respiratory syncytial virus; SD: standard deviation; SOT: single oxygen therapy.

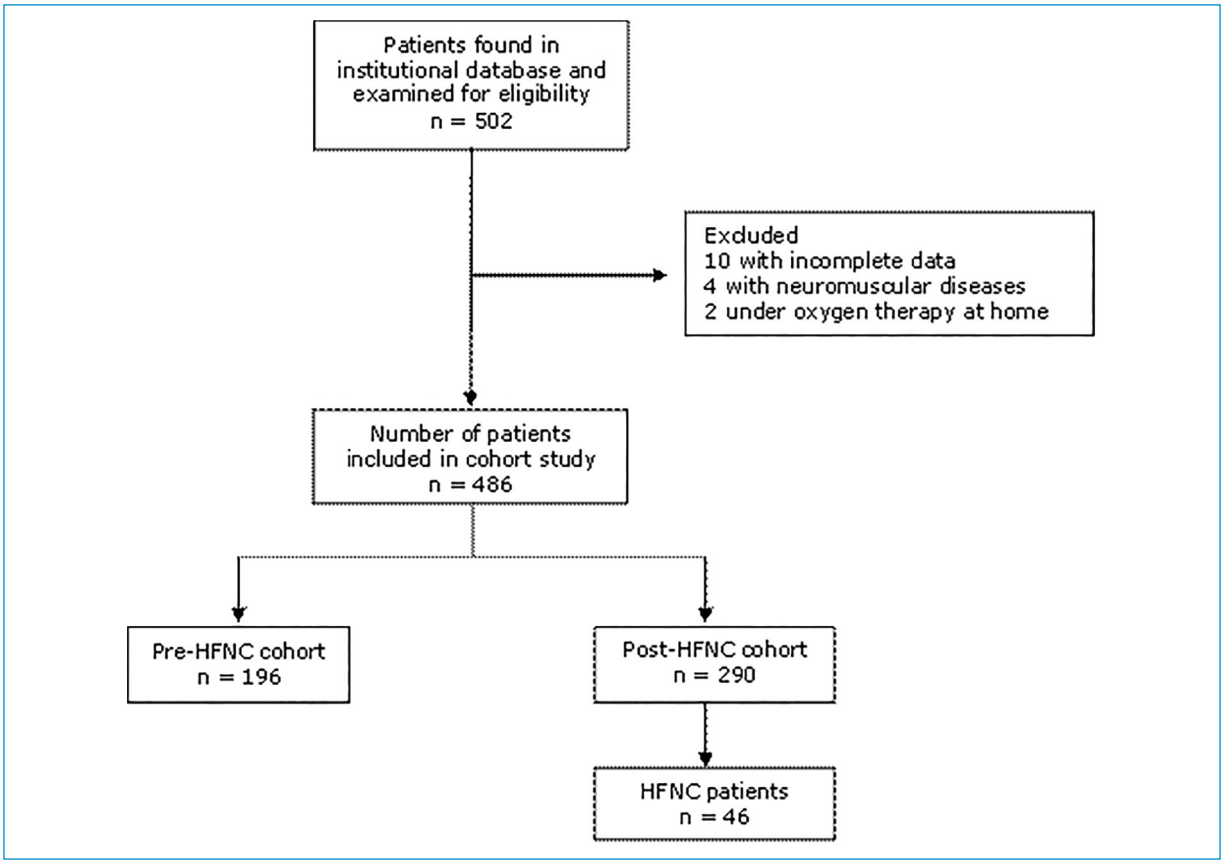

Figure 1. Study profile. Flow chart illustrating the study profile, depicting the progression of participants from enrollment to the final analysis.

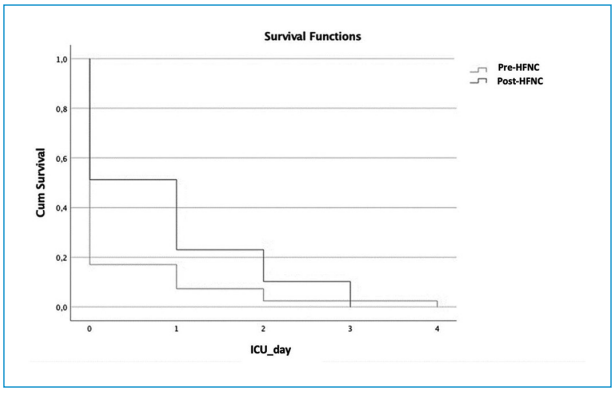

Figure 2. Survival analysis. This figure illustrates the survival analysis depicting the time to Intensive Care Unit (ICU) admission for patients in the preHFNC and postHFNC groups.

In our patients on HFNC oxygen therapy, around 22% needed NIV and none needed IVM. A retrospective study showed that 25% of patients with HFNC therapy required NIV, which is a very similar proportion[8]. The reduction in the need for intubation was also demonstrated in several studies[6].

When looking for predicting factors of HFNC oxygen failure, daycare attendance and HFNC nonresponders, with a higher WARM score 24 hours after initiation were identified. In line with this, Aydin et al. found that the respiratory rate observed in the second hour of the follow-up period could be a predictive factor for HFNC failure[19]. Daycare attendance was never reported as a predictive factor for failure, but it may be explained by the fact that children in daycare are usually at a higher risk of recurrent respiratory tract infections and of more chronic airway inflammation. Besides that, several studies have shown that children at younger ages are particularly vulnerable to daycare-related effects with more severe problems[20].

A strength of this study is that it is the first national study on the use of high-flow oxygen therapy in bronchiolitis, allowing for the adjustment of current national clinical practices to reduce overall length of stay, the

Table 2. Subgroup analysis in the postHFNC period: HFNC therapy vs. nonHFNC subgroups

	HFNC	NonHFNC	p
Participants, n	46	244	
Age in months, mean (SD)	5.18; 5.59	6.15; 11.9	0.738
Male, n (%)	23 (48.9)	133 (54.5)	0.574
Prematurity, n (%)	13 (28.3)	40 (16.4)	0.056
Neonatal respiratory support, n (%)	5 (10.9)	17 (7.0)	0.359
Day of illness, mean (SD)	2.80 (1.72)	4.33 (3.83)	< 0.001
Preexisting comorbidities, n (%)			
Pulmonary disease	2 (4.3)	2 (0.8)	0.060
Cardiac disease	3 (6.5)	6 (2.5)	0.145
Immunodeficiency	0 (0.0)	0 (0.0)	
Chromosomal disorders	1 (2.2)	1 (0.4)	0.185
Neurologic disease	0 (0.0)	8 (3.3)	0.213
Family history of allergies, n (%)	14 (30.4)	95 (39.4)	0.250
Personal history of allergies, n (%)	0 (0.0)	14 (5.8)	0.094
Exposure to tobacco smoke, n (%)	17 (37.0)	99 (41.3)	0.587
Daycare attendance, n (%)	7 (15.2)	48 (21.0)	0.374
Symptoms on admission, n (%)			
Fever	23 (50.0)	106 (43.4)	0.412
Cough	41 (89.1)	227 (93.0)	0.359
Dyspnea	23 (50.0)	142 (58.2)	0.303
Vomiting	7 (15.2)	36 (14.8)	0.935
Diarrhea	3 (6.5)	16 (6.6)	0.993
Physical examination on admission, n (%)			
Nasal flaring, n (%)	5 (10.9)	17 (7.0)	0.359
Wheezing, n (%)	3 (6.5)	12 (4.9)	0.652
Retractions, n (%)			0.098
Subcostal or intercostal	20 (44.4)	124 (50.8)	
Global	21 (46.7)	77 (31.6)	
Lung auscultation, n (%)			0.139
Decreased pulmonary sounds in one area	1 (2.2)	9 (3.7)	
Decreased pulmonary sounds in one area	6 (13.0)	13 (5.3)	
Respiratory rate, mean (SD)	51.52 (13.1)	49.50 (11.4)	0.309
SpO_2, mean (SD)	93.22 (3.63)	93.96 (4.19)	0.269
Weight on admission in Kg, mean (SD)	5.93 (2.23)	6.31 (2.61)	0.820
Warm score, mean (SD)	2.3 (1.4)	1.7 (1.2)	0.002
Virus, n (%)			
RSV	29 (65.9)	161 (70.6)	0.534
Adenovirus	2 (4.5)	5 (2.2)	0.373
Metapneumovirus	6 (13.6)	11 (64.7)	0.028
Rhinovirus	9 (20.5)	39 (17.3)	0.612
Parainfluenza	1 (2.3)	11 (4.9)	0.445
Influenza	1 (2.3)	1 (0.4)	0.195
Enterovirus	9 (20.5)	7 (3.1)	< 0.001
Bocavirus	5 (11.4)	7 (3.1)	0.015
Coronavirus	1 (2.3)	1 (0.4)	0.195
SARS-CoV-2	0 (0.0)	3 (1.2)	0.450
Antibiotics use, n (%)	11 (24.4)	35 (14.3)	0.089
Respiratory support, n (%)			
None	---	51 (20.9)	---
SOT	---	193 (79.1)	---
HFNC	---	---	---
NIV	10 (21.7)	26 (10.7)	0.038
IMV	0 (0)	6 (2.5)	0.282
ICU admission, n (%)	11 (23.9)	29 (11.9)	0.030
ICU length of stay in days, median (SD)	9.5 (2.9)	10.5 (5.9)	0.604
Overall length of stay in days, median (SD)	16.2 (54.2)	7.3 (20.6)	0.278

HFNC: high-flow nasal cannula; ICU: intensive care unit; IMV: invasive mechanical ventilation; NIV: non-invasive mechanical ventilation; RSV: respiratory syncytial virus; SD: standard deviation; SOT: single oxygen therapy.

need for therapeutic escalation, and consequently, the costs involved. However, there are some limitations. One of these lies in the fact that this is a retrospective study. Additionally, we only have three HFNC devices available, which could have influenced their use in the most severe patients or led to ICU transfer without the chance to try HFNC first. Another limitation has to do with the fact that we are a tertiary hospital, which may have conditioned a selection bias, with a population with more severe disease being transferred from other hospitals. Moreover, our timeframe encompassed the period of the pandemic, coinciding with a lower number of patients admitted.

In conclusion, in our cohort, the introduction of HFNC in the treatment of AB reduced the need for the ICU, being associated with a clinical improvement in several respiratory parameters. On the basis of the NNT, it is estimated that three to four ICU admissions were avoided in the postHFNC group. It is imperative that we establish the efficacy of HFNC therapy compared to standard care in the management of AB, assessing potential differences in efficacy according to the time of initiating the HFNC. While a few observational studies have shown promising results for HFNC, the evidence base is limited by the lack of well-designed randomized controlled trials with the measurement of simple and composite outcomes. These studies would enable a more rigorous evaluation of HFNC therapy, allowing for a better determination of its safety and efficacy. Moreover, the use of standardized outcome measures would ensure that results are comparable across studies and settings. Large sample sizes and long-term follow-up periods are particularly desirable, as they would provide robust evidence for the use of HFNC in clinical practice. With such evidence, clinicians and policymakers would be better equipped to make informed decisions about the appropriate use of HFNC therapy, ultimately improving patient outcomes and reducing health care costs.

Previous presentations

This investigation was presented at the 22nd National Pediatric Conference in October 2023 and received the award for the best works at the conference.

Author contributions

J. Costa Leite Baptista de Lima: Conception and design of the study, report, review or other type of work or paper; Acquisition of data either from patients, research studies, or literature; Analysis or interpretation of data either from patients, research studies, or literature; Drafting the article; Critical review of the article for important intellectual content; Final approval of the version to be published; Agreement to be accountable for the accuracy or integrity of the work. I. Aires Martins, J. Queirós, S. Monteiro: Acquisition of data either from patients, research studies, or literature; Analysis or interpretation of data either from patients, research studies, or literature; Critical review of the article for important intellectual content; Final approval of the version to be published; Agreement to be accountable for the accuracy or integrity of the work. T. Barbosa, M. Guilhermina Reis, L. Morais, A. Ramos: Critical review of the article for important intellectual content; Final approval of the version to be published; Agreement to be accountable for the accuracy or integrity of the work. M. Ferreira-Magalhães: Conception and design of the study, report, review or other type of work or paper; Analysis or interpretation of data either from patients, research studies, or literature; Critical review of the article for important intellectual content; Final approval of the version to be published; Agreement to be accountable for the accuracy or integrity of the work.

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Conflicts of interest

None.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve patient personal data nor requires ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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