Evaluation of the BronchiolitisMAD protocol in the out-of-hospital emergency services of the Community of Madrid

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Abstract

The objective of this study was to evaluate the BronchiolitisMAD protocol after its implementation in the out-of-hospital emergency services (OHES) of the Autonomous Community of Madrid (ACM), assessing the clinical improvement during the transfer, application of adequate respiratory therapy, and reduction of response times. This is a descriptive, cross-sectional, and retrospective study in the OHES of the ACM, comparing the season prior to the establishment of the BronchiolitisMAD protocol (October 1, 2019, to March 31, 2020) and the subsequent season (October 1, 2022, to March 31, 2023), excluding the epidemic period of the COVID-19 pandemic. The protocol's key point is a stepwise approach based on the severity of the child's bronchiolitis. It provides detailed algorithms and checklists for treatment and transfer decisions. Specific instructions are provided for using an incubator during the transport of critically ill infants. Seventy-nine patients were included. In the post-protocol season, the use of non-invasive mechanical ventilation increased (from 7.5% to 51.3%) in a statistically significant manner. When comparing the initial and final assessment of the patient pre- and post-protocol, in the post-protocol season, there was a reduction in tachycardia (from 71.8% to 42.3%) and tachypnea (from 69.2% to 46.2%), with an increase in the SaFi ratio ($p<0.05$). A reduction in T1-activation and T2-stabilization times was observed. The BronchiolitisMAD protocol allowed the implementation and generalization of up-to-date care for infants with acute bronchiolitis.

Introduction

Acute bronchiolitis is one of the epidemic pediatric respiratory infections that most frequently requires hospitalization.[1,2] Each year, it causes the collapse of hospital emergency departments (HED) and pediatric intensive care units (PICU), as well as out-of-hospital emergency services (OHES). In addition to caring for patients with bronchiolitis at home, these services also have to perform inter-hospital transfers of the most seriously ill patients from hospitals that do not have pediatric or neonatal intensive care units (ICUs) to those that do.

In Spain, transfers of pediatric patients, typically those under 12 months of age, are conducted by the OHES. These patients often require specialized resources for their treatment, particularly for respiratory conditions. It is essential that the personnel involved possess the appropriate knowledge and training to ensure optimal management of these young patients.

The OHES of the Community of Madrid (ACM) is responsible for: i) primary care, *i.e.*, providing care to the patient at home or in the street, and ii) interhospital transfers. Primary care can be car-

ried out with a Mobile Medical Assistance Unit, if the patient's pathology is not an emergency, or in a mobile ICU if it is. Interhospital transfers, depending on the type of pathology and age of the patient, can be carried out in Basic Life Support, mobile ICU, or specialized neonatal transport equipment (incubator with neonatologist). Thus, primary care is provided by non-neonatal OHES teams, and interhospital transfers are performed by non-neonatal OHES teams (in patients ≥29 days of life) and the Neonatal Transport team (in patients ≤28 days of life and/or younger than 44 weeks postmenstrual age). Within the OHES, the emergency health centers (hospitals and primary care) are excluded, including only the mobile care units.

In the OHES in Spain, all physicians, in addition to a specialty (family medicine, anesthesiologist, intensivist, etc.), are required to have a master's degree in emergency medicine approved by the university. In the Community of Madrid, interhospital transfers of patients <28 days and/or less than 44 weeks postmenstrual age are carried out by the mobile neonatal intensive care unit transport team. This team includes a neonatologist with regular activity in the level III Hospital Neonatology Service and training in out-of-hospital transport. It is worth mentioning that there were no bronchiolitis procedures or clinical guidelines published in the OHES for the performance of interhospital transfers and primary care at home.

Thus, the OHES of the ACM have developed and implemented the BronchiolitisMAD protocol, which can be consulted in detail in Gómez-Morán Quintana M *et al.*[3] This protocol is prepared by a multidisciplinary team made up of pediatric intensivists and neonatologists from tertiary hospitals of the ACM, neonatologists from the neonatal transport team of the OHES of the ACM, and emergency physicians (doctors, nurses, and emergency health technicians of the OHES of the ACM) specialized in the area of ventilation and pediatrics.

The BronchiolitisMAD protocol has been implemented by the OHES of the Community of Madrid for managing and treating bronchiolitis in children at home or during transport to a hospital. The OHES play a crucial role in managing bronchiolitis cases, providing primary care at home, and interhospital transfers for severe cases. The goals of this bronchiolitis protocol are several: i) improve clinical outcomes for children with bronchiolitis treated by OHES; ii) ensure appropriate respiratory therapy based on the severity of the illness; and iii) reduce response times for OHES interventions. The key point of the protocol is a tiered approach based on the severity of the child's bronchiolitis. Mild cases are managed at home with oxygen therapy and discharge recommendations. Moderate cases require non-invasive ventilation (NIV) with high-flow nasal cannula (HFNC), continuous positive airway pressure (CPAP), or bi-level positive airway pressure (BiPAP) during transport to a hospital.

Severe cases are supported with invasive mechanical ventilation (IMV) and immediate transport to a hospital with ICU capabilities. The protocol provides detailed algorithms and checklists for treatment and transfer decisions. Medications for pain relief and sedation are outlined for procedures like NIV and IMV.

Specific instructions are provided for incubator use during the transport of critically ill infants. The protocol's benefits include: a standardized approach to managing bronchiolitis by OHES personnel; improved care for children with bronchiolitis, potentially reducing hospitalizations; clear guidelines for respiratory therapy based on severity; efficient use of resources; and faster response times.

Overall, the BronchiolitisMAD protocol is a comprehensive guide for OHES personnel to provide effective and timely care for children with bronchiolitis in the out-of-hospital setting.

It was implemented during the period from March to October 2022, with multiple training sessions. The emphasis was on treatment based on the severity of the patient's bronchiolitis, management and training of ventilation support with a high-flow nasal cannula, non-invasive mechanical ventilation (NIMV) such as CPAP and BiPAP, and invasive mechanical ventilation (IMV), both in the event of being transferred with an incubator and in a mobile ICU.

Therefore, the objective of this research is to evaluate the BronchiolitisMAD protocol after its implementation in the OHES of the ACM, assessing the clinical improvement during the transfer, application of appropriate respiratory therapy, and reduction of response times in patients treated by the OHES of the ACM.

Materials and Methods

Type of study

A descriptive, cross-sectional, and retrospective observational study was conducted in the OHES of the ACM, Spain, comparing the season prior to the establishment of the BronchiolitisMAD protocol (October 1, 2019, to March 31, 2020) and the subsequent season (October 1, 2022, to March 31, 2023), excluding the epidemic period coinciding with the COVID-19 pandemic (2020/2021, 2021/2022).

Interventions

The professionals of the OHES of the ACM (both in the medical and nursing categories) received specific training on the BronchiolitisMAD protocol between March and September 2022, before the bronchiolitis season of 2022/2023. Sixteen sessions of 10-hour theoretical and practical workshops were given together with an algorithm, training videos (available online), and a QR code located in the pediatric backpacks of the mobile ICUs of the OHES of the ACM with the instructions to be followed in the handling of the necessary devices.

The theoretical topics included a detailed explanation of the BronchiolitisMAD protocol, structured according to the classification of bronchiolitis based on the modified Tal scale (mild, moderate, or severe). These topics are divided into 3 classes: i) application of the protocol in children >5 kg, who can be transferred with mobile ICU; ii) patients <5 kg who have to be ventilated with pediatric/neonatal ventilator and therefore be transferred in the incubator; iii) incidences when treating the most frequent clinical cases of bronchiolitis and how to resolve them. The practical workshops were simultaneous workshops: i) programming of HFNC, NIV (CPAP and BiPAP), and invasive by the mobile ICU ventilator in children >5 kg; ii) programming of the incubator ventilator (both NIV and invasive); iii) incubator management. Finally, there were practical cases to be solved by the students.

To coordinate all the levels of care involved, the protocol was disseminated to the sending hospitals of the ACM that most demand interhospital transfers of patients with bronchiolitis, with 40-minute explanatory sessions.

Study population and data collection

All patients with a diagnosis of bronchiolitis (according to ICD-10) ≤24 months of age and >28 days (transfers of patients ≤28 days are performed by a specialized Neonatal Transport team) who underwent home care or interhospital transfer in the bronchiolitis epidemic season of 2019/2020 and 2022/2023 were included.

The information was obtained through the electronic health records, which were provided by the Information Technology Service of the Community of Madrid.

Variables of the study

A total of 25 variables were recorded and classified into the following groups: i) general patient characteristics: age and sex; ii) initial (first assessment of the patient at home or upon arrival at the sending hospital in the case of inter-hospital transfers) and final (upon arrival at the receiving hospital) clinical situation of the patient: hemoglobin saturation (Sat02), SaFi ratio (Sat02/ FiO2), tachypnea (respiratory rate >95th percentile for age), and tachycardia (heart rate >95th percentile for age), and modified Tal severity score;[4] iii) respiratory support at the start of care (at home or sending hospital) and upon arrival at the receiving hospital: conventional oxygen therapy (nasal cannula, high flow venturi mask or high concentration reservoir type mask), high flow nasal cannula, non-invasive mechanical ventilation (CPAP or BiPAP type), and invasive mechanical ventilation; iv) response times of the care resource: T1-activation (from activation of the resource until first contact with the patient at home/sending hospital), T2-stabilization (from first patient care at home or sending hospital until departure to the receiving hospital), T3-transfer (from departure to the receiving hospital until arrival at the receiving hospital), T4-return to operation (from arrival at the receiving hospital until repositioning and resource availability for further activation).

Statistical analysis

The statistical analysis included a descriptive and an analytical aspect. The latter evaluates changes in clinical and therapeutic variables and response times before and after the implementation of the BronchiolitisMAD protocol.

In the descriptive analysis, qualitative variables were expressed as frequencies and percentages, and mean with standard deviation (SD) or median and interquartile range (IQR) for quantitative variables. In the comparative or analytical analysis, qualitative or categorical variables were compared using the Pearson $\chi 2$ test, and quantitative variables that followed a normal distribution were compared using Student's *t-test*; if they did not follow the normal distribution, the Mann-Whitney test was used. For categorical independent variables, a $\chi 2$ test of independence was performed by grouping the categories that had expectancy <5 and obtaining a single p-value for all of them. Statistical analysis was carried out using STATA statistical software (Stata: Statistical software for data scienceStatahttps://www.stata.com) version®17.0.

Results

General characteristics

The patient populations in both seasons were similar in terms of general characteristics and initial clinical situation, which ensures that the groups are comparable, as shown in Table 1. Although there were no statistically significant differences in aspects such as age, sex, or initial signs of tachypnea and tachycardia, these observations reinforce the populations' homogeneity.

To assess the severity of bronchiolitis, we used the modified Tal scale,[4] which classifies patients' conditions as mild, moderate, or severe. Most cases in both seasons were considered mild, while moderate and severe cases were less frequent and similarly distributed in both groups. To clarify, mild bronchiolitis refers to mild respiratory symptoms with oxygen saturation >92% and scores ≤5; moderate refers to more marked involvement with saturations between 88-92% and scores from 6 to 9; and severe refers to cases where saturation is less than 88% and advanced ventilatory support is required, reflected in scores ≥10. It should be noted that no significant differences were found in these categories between the two seasons.

Seventy-nine patients with bronchiolitis were included: 40 (50.6%) were treated in the pre-protocol season (October 1, 2019, to March 31, 2020) and 39 (49.4%) in the post-protocol season (October 1, 2022, to March 31, 2023). The descriptive characteristics of both groups are shown in Table 1, and no significant differences were found in the general epidemiological characteristics or in the initial clinical situation in which the OHES were with patients between the two seasons, *i.e.*, they are comparable populations.

In the patient's final evaluation during the post-protocol season, a statistically significant reduction was observed in the presence of tachycardia (from 87.5% to 42.3%) and tachypnea (from 83.3% to 46.2%), as well as a decrease in applied FiO2 and an increase in the SaFi ratio.

Regarding respiratory support, there was a statistically significant increase in the use of NIMV in the post-protocol stage (from 7.5% to 51.3% of patients transferred).

Approximately 25% of the patients (9/40 in the pre-protocol season and 9/39 in the post-protocol season) did not require respiratory support. They were not transferred to the hospital and were treated at home.

Comparative analysis of initial and final pre- and post-protocol patient assessment

The variables during the first and final patient assessments were compared in both the pre-protocol group (Table 2) and the post-protocol group (Table 3).

It should be noted that during the pre-protocol season, patients presented a statistically significant increase in tachycardia (from 68.4% to 87.5%) and tachypnea (from 68.4% to 83.3%) and a reduction in the SaFi ratio (from 262.9 to 168.2) from the sending hospital to arrival at the receiving hospital. However, in the post-protocol season, there was a statistically significant reduction in tachycardia (from 71.8% to 42.3%) and tachypnea (from 69.2% to 46.2%) in the final assessment compared to the initial assessment, with an increase in the SaFi ratio.

Analysis of response times

The comparative analysis of response times is shown in Table 4. In the post-protocol season, a statistically significant reduction in T1-activation and T2-stabilization times was observed.

Discussion

The implementation of the BronchiolitisMAD protocol in the OHES of the ACM has led to an improvement in the clinical situation of the patients on arrival at the receiving hospitals, with a significant decrease in the presence of tachycardia (from 71.8% to 42.3%, p<0.001) and tachypnea (from 69.2% to 46.2%, p<0.001) in the final assessment of the transfer, as well as a slight increase in the SaFi ratio (from 298 to 268). The results indicate a significant increase in the early use of non-invasive ventilation during transfers (7.5% to 51.3%, p<0.001). This improvement occurred without an increase in response times; in fact, a decrease in stabi-

lization time was observed.

Although tachypnea and respiratory rate improved in patients treated with the bronchiolitisMAD protocol, these parameters can be influenced by other factors such as crying or fever. However, the FiO2 to be applied to the patient and the SaFI index also showed a statistically significant reduction.

The results have demonstrated how implementing and disseminating a protocol based on scientific evidence can improve the quality of care in out-of-hospital care. Many studies have shown how the implementation of protocols, especially in relation to the management of bronchiolitis,[5-8] has made it possible to systematize and unify the management of this type of pathology. Bronchiolitis is a condition where various quality improvement strategies have been described,[9] but few have focused on the emergency services setting,[5] and even fewer have addressed the OHES. Tyler *et al.*[8] developed a protocol to systematically implement the recommendations from the American Academy of Pediatrics regarding the management of bronchiolitis. They shared this protocol with all staff members, resulting in a significant reduction in the use of microbiological and imaging tests, in line with international guidelines. With a similar objective, Jiménez García *et al.*,[6] compared the use of non-recommended resources for the care of patients with bronchiolitis in emergency services before and after the implementation of a systematic protocol. Their findings demonstrated that, following the protocol's implementation, there was a notable decrease in the use of bronchodilators and rapid detection tests for respiratory syncytial virus. In pursuit of this same objective, both Andina *et al.*[5] and Montejo *et al.*,[7] under the slogan «Bronchiolitis, less is more,» achieved a significant reduction in the prescription of salbutamol, as well as adrenaline, corticoids, and antibiotics in the emergency services.

Despite all the evidence supporting the implementation of protocols for the management of bronchiolitis in emergency services, there is no such systematic approach for its management in the OHES, which is also carried out by personnel who are not dedicated to pediatric patients. Research has shown that pediatric trans-

Table 1. Descriptive analysis of bronchiolitis patients in the pre- and post-protocol seasons.

Bronchiolitis epidemic season	Pre-protocol	Post-protocol	p
N	**40**	**39**	
General epidemiological characteristics			
Age (months) [median (IQR)]	10.0 [8.4-11.6]	7.2 [6.4-8.0]	0.07
Sex female [n (%)]	14 (36.8)	18 (46.2)	0.4
Initial situation of the patient			
Clinical			
Tachypnea [n (%)]	26 (68.4)	27 (69.2)	0.9
Tachycardia [n (%)]	26 (68.4)	28 (71.8)	0.59
SatO2 [mean (SD)]	94.5 (8.0)	95.3 (5.3)	0.64
FiO2 [mean (SD)]	55.5 (35.6)	43.6 (30.1)	0.12
SaFi ratio [mean (SD)]	262.9 (153,6)	298.7 (135.0)	0.28
Modified Tal severity score			0.38
Mild [n (%)]	25 (62.5)	18 (46.1)	
Moderate and severe [n (%)]	15 (37.5)	21 (53.9)	
Final situation of the patient			
Clinical			
Tachypnea [n (%)]	20 (83.3)	12 (46.2)	0.006
Tachycardia [n (%)]	21 (87.5)	11 (42.3)	<0.001
SatO2 [mean (SD)]	97.0 (3.0)	98.3 (1.6)	0.07
FiO2 [mean (SD)]	75.5 (33.0)	46.2 (28.3)	0.002
SaFi ratio [mean (SD)]	168.2 (121.6)	268.1 (104.1)	0.003
Modified Tal severity score			0.62
Mild [n (%)]	25 (62.5)	18 (46.1)	
Moderate and severe [n (%)]	15 (37.5)	21 (53.9)	
Respiratory support			
NO respiratory support [n (%)]	9 (22.5)	9 (23.0)	0,8
Conventional oxygen therapy [n (%)]	27 (67.5)	6 (15.3)	<0.001
High flow nasal cannula [n (%)]	1 (2.5)	1 (2.5)	0.72
NIMV (CPAP or BiPAP) [n (%)]	3 (7.5)	20 (51.3)	<0.001
IVM [n (%)]	0 (0)	3 (7.7)	0.06
Pharmacological therapy			
Salbutamol [n (%)]	12 (21.6)	7 (17.9)	0.17
Sedation (midazolam or morphine) [n (%)]	3 (7.9)	3 (7.7)	0.97
Corticoids (prednisolone or metilprednisolone) [n (%)]	3 (7.9)	1 (2.6)	0.19
Corticoid + paracetamol [n (%)]	2 (5.3)	0 (0)	0.19

N, number of patients; RIQ, interquartile range; SatO2, hemoglobin saturation; FiO2, fraction of inspired oxygen; SaFi, hemoglobin saturation/fraction of inspired oxygen; SD, standard deviation; conventional oxygen therapy: nasal cannula, high flow venturi mask or high concentration reservoir type mask; NIMV, non-invasive mechanical ventilation; CPAP, continuous positive airway pressure; BiPAP, bilevel positive airway pressure; IVM, invasive mechanical ventilation.

port performed by specialized personnel allows anticipation of possible medical and transport complications and has both short- and long-term benefits (reduction of morbidity and mortality, complications, hospital stay, etc.).[10-12] However, if specialized transport is not available, it is critical that OHES personnel receive pediatric and neonatal patient training, as well as implement protocols for specific pathologies in these age groups.[13]

Within bronchiolitis as a specific pediatric pathology, in addition to the «less is more» approach of using fewer bronchodilators, adrenaline, corticoids, and so on, one of the few measures that have shown clinical improvement is the use of non-invasive ventilation, with significant improvements in constants such as respiratory rate, heart rate, blood pressure, capillary refill, and oxygen saturation, especially when initiated early.[14] Therefore, among the parameters to be assessed to see the effect of the implementation of the BronchiolitisMAD protocol, both respiratory and cardiac frequency adapted to the age of the patient were used. When comparing these parameters in the initial and final assessment of the transfer, both in the pre- and post-protocol stages, we observed that the previous management even led to a significant increase in the cardiac and respiratory frequency of the patients (p<0.001). However, the implementation of the protocol based on general measures and the increased use of NIMV during transfer (from 7.5% to 51.3%) allowed patients with similar characteristics to

Table 2. Comparative analysis of initial and final patient assessment in the PRE-protocol season.

Pre-protocol season	Initial assessment	Final assessment	p
N	40	40	
Clinical			
Tachypnea [n (%)]	26 (68.4)	20 (83.3)	<0.001
Tachycardia [n (%)]	26 (68.4)	21 (87.5)	<0.001
SatO2 [mean (SD)]	94.5 (8.0)	97.0 (3.0)	0.7
FiO2 [mean (SD)]	55.5 (35.6)	75.5 (33.0)	0.05
SaFi ratio [mean (SD)]	262.9 (153.6)	168.2 (121.6)	<0.001
Modified Tal severity score			0.8
Mild [n (%)]	10 (41.7)	10 (41.7)	
Moderate and severe [n (%)]	14 (58.3)	14 (58.3)	

N, number of patients; SatO2, hemoglobin saturation; SD, standard deviation; FiO2, fraction of inspired oxygen; SaFi, hemoglobin saturation/fraction of inspired oxygen.

Table 3. Comparative analysis of initial and final patient assessment in the post-protocol season.

Post-protocol season	Initial assessment	Final assessment	p
N	39	39	
Clinical			
Tachypnea [n (%)]	27 (69.2)	12 (46.2)	<0.001
Tachycardia [n (%)]	28 (71.8)	11 (42.3)	<0.001
SatO2 [mean (SD)]	95.3 (5.3)	98.3 (1.6)	0.62
FiO2 [mean (SD)]	43.6 (30.1)	46.2 (28.3)	0.3
SaFi ratio [mean (SD)]	298.7 (135.0)	268.1 (104.1)	0.05
Modified Tal severity score			0.4
Mild [n (%)]	18 (46.1)	18 (46.1)	
Moderate and severe [n (%)]	21 (53.9)	21 (53.9)	

N, number of patients; SatO2, hemoglobin saturation; SD, standard deviation; FiO2, fraction of inspired oxygen; SaFi, hemoglobin saturation/fraction of inspired oxygen.

Table 4. Comparative analysis of response times in pre- and post-protocol seasons.

Season	Pre-protocol (N=38)	Post-protocol (N=39)	P-value
Times (minutes)			
T1-activation [median (IQR)]	27.0 (26.4-27.6)	24.0 (23.5-24.5)	0.01
T2-stabilization [median (IQR)]	30.5 (29.0-31.8)	25 (23.8-26.2)	<0.001
T3-transfer [median (IQR)]	12.2 (12.1-12.3)	12.0 (12.0-12.1)	0.8
T4-return to operation [median (IQR)]	48 (46.3-49.7)	50 (44.2-55.8)	0.48

N, number of patients; T1-activation, from activation of the resource until first contact with the patient at home/sending hospital; T2-stabilization, from first patient care at home or sending hospital until departure to the receiving hospital; T3-transfer, from departure to the receiving hospital until arrival at the receiving hospital; T4-return to operation, from arrival at the receiving hospital until repositioning and resource availability for further activation.

arrive at the receiving hospital with less tachycardia and less tachypnea ($p<0.001$). Hensel *et al.*[14] established that in adults with exacerbations of chronic lung disease, the use of NIMV during transfer by OHES led to better outcomes compared to a historical control group of similar patients who were not treated with NIMV during transfer. The study demonstrated that patients who received NIMV showed improvements in several assessed parameters, including heart rate, respiratory rate, blood pressure, and oxygen saturation. This was contrasted with patients who were transferred using conventional methods, which involved semi-sitting positioning, high-flow oxygen administered via mask, and symptomatic treatments such as salbutamol. Although the use of NIMV resulted in a slight increase in stabilization time by a few minutes, the authors argue that this minimal delay is justified given the strong evidence supporting the benefits of NIMV. In the implementation of the BronchiolitisMAD protocol, it was also observed that after appropriate training, the stabilization time for pediatric patients with bronchiolitis using NIMV for transfer was significantly reduced ($p<0.001$).

There is evidence regarding the usefulness and safety of using NIMV in pediatric patients with acute respiratory failure in transfers – with bronchiolitis being the most frequent, followed by asthma and pneumonia – when performed by specialized pediatric and neonatal transport teams.[15] As a result, protocols for selecting appropriate patients and providing respiratory management training are critical, especially when such transfers are performed by non-specialized personnel.

The BronchiolitisMAD protocol has not only provided objective data but also improved the training of OHES professionals. This enhancement ensures greater safety for professionals when treating pediatric patients, as adult patients are typically the most frequently treated in this setting.

Treatment criteria have been unified both in OHES and in hospital transfers. This reduces the resource's operating times and speeds up transfers between OHES and hospitals, where the majority of patient care time is spent. Another advantage of the protocol is that it can be consulted at any time via a QR code, which aids in patient care.

The training given to professionals to implement the protocol has served to update healthcare professionals by implementing safety in the treatment of patients with bronchiolitis.

Limitations

This study was conducted by a single OHES, and it utilizes retrospective controls; therefore, some factors that could influence the analysis of the results might not be accounted for. Although the sample size is relatively small, appropriate statistical tests were employed, and the results were found to be statistically significant.

Data on the evolution of patients in the hospital, hospital stays, or cost-effectiveness could not be presented because it would require reviewing new hospital records. However, this would be an interesting line of future research.

The year omitted from the study coincided with the COVID-19 pandemic. It was excluded because, during this time, the Community of Madrid implemented a protocol for managing respiratory patients that restricted the use of NIV and HFNC due to the high risk of associated infections. These treatments were only applied in specific cases of severe clinical severity and where no other ventilatory options were available.

As a result, there has been an increased use of NIV and HFNC following the implementation of the bronchiolitis protocol. This change can be attributed to enhanced training for healthcare professionals and the observation of improved clinical outcomes in patients receiving these treatments, independent of the COVID-19 pandemic's effects on non-invasive mechanical ventilation usage.

Conclusions

Standardization and training in the management of bronchiolitis among OHES personnel improves the clinical situation of patients upon arrival at receiving hospitals without prolonging the stabilization time and the total transfer time to reach the appropriate specialized center. In the implementation of the protocol, it is fundamental to establish the «what not to do» and the early application of non-invasive ventilation to reduce the need for intubation, among other advantages demonstrated in the scientific evidence. Therefore, it is essential to maintain continuous and updated training in the OHES of this pediatric pathology.

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