

Original Article

Comparison between the drug treatment used in children up to five years of age treated in an emergency room and the guidelines established in the III Brazilian Consensus on Asthma Management*

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Abstract

Objective: To evaluate the management of asthma attacks in children up to five years of age treated in the pediatric emergency room of a hospital in the metropolitan area of the city of Recife, Brazil, as well as to determine whether the way in which asthma attacks are managed can influence the duration of emergency room visits for such children. **Methods:** A descriptive, exploratory study employing a quantitative, cross-sectional approach. The study sample comprised 246 children treated for asthma attacks in an emergency room. The approach used was evaluated in comparison with the approach recommended in the III Brazilian Consensus on Asthma Management, as was the length of time each child spent in the emergency room. **Results:** In 69 (28.1%) of the cases, the medications were used in accordance with the Consensus guidelines. In 34 (13.8%) of the cases, the doses used were those recommended in the Consensus guidelines, and the guidelines regarding nebulization procedures were followed in 33 cases (13.4%). No correlation was found between the approach taken and the length of the emergency room visit. In the logistic regression analysis, we observed that the adjusted risk of being released from the emergency room sooner than recommended in the Consensus guidelines (a length of time sufficient to allow the response to the treatment to be analyzed) was four times and fifteen times greater, respectively, for children with mild persistent asthma and for those with intermittent asthma. **Conclusion:** Although there are obstacles to using the asthma management approach recommended in the Consensus guidelines (such obstacles including the lack of familiarity with the guidelines on the part of the multidisciplinary team, as well as the lack of recommended material and therapeutic resources), the duration of emergency room visits was found to be related to the degree of asthma severity.

Keywords: Emergency medicine; Pediatrics; Asthma; Status asthmaticus.

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Introduction

Among all of the countries in the world, Brazil presents the eighth highest frequency of asthma (20%),⁽¹⁾ which ranges from 4.7% to 20.7% among children between six and seven years of age.⁽²⁾ In the city of Recife, Brazil, the results of the International Study of Asthma and Allergies in Childhood, in which 3086 adolescents between thirteen and fourteen years of age and 1410 children between six and seven years of age were interviewed, revealed that 20.9% and 20.4% of the interviewees, respectively, had a history of asthma.⁽³⁾

Guidelines and consensuses have been established with the aim of orienting the diagnosis of bronchial asthma as well as of standardizing its evaluation and treatment approaches.⁽¹⁻⁵⁾ However, studies show great variability in the pattern of clinical practice in the treatment of these patients, which interferes with the quality of the treatment.⁽⁶⁻⁷⁾ The advances in clinical approach within the past ten years have not been incorporated into the clinical practices used in treating most patients.⁽⁸⁾ This can be demonstrated by the fact that constant visits to the emergency room continue, which presupposes inappropriate treatment.⁽⁹⁾

In the literature, the explanations for the increase in the rates of hospital admission for asthma are varied and controversial. Some studies offer explanations such as the introduction of nebulization therapy in the 1970s and the consequent increase in the emergency room availability of nebulization;⁽¹⁰⁾ low socioeconomic level and limited access of the low-income population to the health care system;⁽⁸⁾ age bracket, especially the younger than five years of age bracket; inappropriate prophylactic treatment;⁽¹¹⁾ lack of regular follow-up treatment of the disease;⁽¹²⁾ as well as the increase in the prevalence and severity of the disease and its underdiagnosis.⁽¹³⁾

The relationship between inappropriate outpatient approaches to the treatment of asthma in the frequent visits to the emergency room and the higher risk of serious or fatal asthma attacks is well-known. However, for the low-income population in Brazil, the emergency room is often the principal or only means of access to the health care system.⁽¹⁴⁾ In Brazil, 16% of the emergency room visits by children are for acute asthma attacks.⁽¹⁵⁾

In 1999, questionnaires about the management and treatment of asthma patients in the country were completed by ten (50%) of the presidents of the regional councils of the Brazilian Thoracic Society. Inappropriate asthma management in low-income patients was attributed to lack of appropriate medication, insufficient resources to purchase such medication, and functional difficulties related to public service.⁽¹⁶⁾

The objective of the present study was to identify the management of asthma attacks in children up to five years of age treated in an emergency room of a hospital in the greater metropolitan area of the city of Recife, Brazil, as well as to determine whether the way in which asthma attacks are managed can influence the duration of emergency room visits for such children. The guidelines established in the 2002 III Brazilian Consensus on Asthma Management (BCAM) were used as parameters.

Methods

A descriptive, exploratory study employing a quantitative, exploratory approach was carried out in the pediatric and adult emergency room of a hospital in the city of Camaragibe (in the state of Pernambuco, Brazil) that treats Unified Health Care System patients exclusively.

The study sample comprised 246 children of up to five years of age, of both genders, diagnosed with asthma and treated in the emergency room between August and October of 2003. In addition, these children had a history of at least two previous episodes of dyspnea and wheezing, which were alleviated by bronchodilator use, and had been experiencing symptom exacerbations in the preceding days or hours. Children who, in addition to the asthma attack, presented accompanying physician-diagnosed infection, based on patient history and clinical evaluation, were excluded from the sample.

The instrument used for data collection consisted of a form on which the researcher recorded data regarding demographic factors (gender and age), the treatment given to each child, and the intensity of the asthma attack, established in accordance with the III BCAM parameters. After the completion of the form, a questionnaire was administered to each parent or guardian in order to evaluate asthma severity. Although this is also in accordance with

the III BCAM, it might introduce a bias, since it depends on the memory of the guardians rather than on previous records.

The analysis variables, presented herein, were precoded using the designations 'as recommended' or 'not as recommended' in accordance with the criteria established in the III BCAM in its algorithm for the treatment of children presenting asthma attacks in the emergency room: factors related to the medications administered (medication doses, corticosteroid use in the first hour of treatment, and the use of anticholinergics); factors related to the nebulization therapy (use and control of oxygen flow); and duration of the emergency room visit.

The data were entered into a Microsoft Excel® (version 2000) database, and the Statistical Package for the Social Sciences (version 10.0) program was used to process and analyze the data. The test of independence (known as a measure of association) was used in order to evaluate the relationship between each variable and the continuous variable 'duration of the visit'. Logistic regression was used to define the explanatory variables of the model.

The study design was approved by the Ethics in Research Committee of the Federal University of Pernambuco and was authorized by the administration of the institution. All parents, guardians or legal representatives of the same gave written informed consent.

Results

Of the 246 children studied, 116 (47.2%) were female and 130 (52.8%) were male. The highest number of visits occurred among children between one and three years of age (43.5%), and there were no visits by children under six months of age. None of the children underwent outpatient monitoring for treatment between asthma attacks. Clinical histories suggestive of intermittent asthma were identified in 112 (45.5%) of the children. During the crises, mild or moderate forms predominated in 206 (83.7%) of the cases, and the severe forms occurred less frequently (Table 1).

The medications available in the emergency room were fenoterol, ipratropium bromide, dexamethasone (in suspension or in injectable form), and aminophylline. Fenoterol was used in all of the treatments. Ipratropium bromide was used in 210 children, dexamethasone was used in 136 chil-

Table 1 - Distribution of the sample by gender, age, asthma severity and intensity of asthma attacks, Camaragibe - Brazil.

Variable	n	%
Gender		
Female	116	47.2
Male	130	52.8
Total	246	100.0
Age (years) ^a		
≤ 1	77	31.3
> 1-3	107	43.5
> 3-5	62	25.2
Total	246	100.0
Type/Severity of Asthma		
Intermittent	112	45.5
Persistent/Mild	61	24.8
Persistent/Moderate	61	24.8
Persistent/Severe	12	4.9
Total	246	100.0
Intensity of Asthma Attack		
Mild or Moderate	206	83.7
Serious	36	14.6
Very Serious	4	1.7
Total	246	100.0

^amedian, 2 years.

dren, and aminophylline was used in 4 children (Table 2).

The use of the medications was in accordance with the III BCAM in 69 (28.1%) of the cases. The doses of all of the medications administered were in accordance with the Consensus guidelines in 34 (13.8%) of the cases. The route of administration of the corticosteroid used was in accordance with the Consensus guidelines in 76 (55.9%) of the 136 cases. In 33 (13.4%) of the cases, the nebulization procedure was performed using oxygen at a flow rate of 6 L/min (Table 2).

The doses of fenoterol used were those recommended in the Consensus guidelines in 61 (24.8%) of the cases. Ipratropium bromide was used in 210 procedures. However, there was only one case in which the dose was that recommended in the III BCAM. The results for corticosteroids refer to dexamethasone (in suspension or injectable), after the calculation of doses that were equivalent to the recommended doses of prednisone.⁽¹⁷⁾ In 44 (32.4%) of the cases, doses that were equivalent to the recommended doses of prednisone were observed (Table 2).

The use of oxygen and the flow rate recommended in the III BCAM were observed in 83 (33.7%) of the cases. However, the recommended nebulization protocol (one nebulization every 20 min for the first hour) was followed in only 33 (13.4%) of the procedures (Table 2).

The test of independence for the association between the duration of emergency room visits and the other variables separately (Table 3) suggests that the duration of emergency room visits is associated with corticosteroid use in the first hour, as

well as with the intensity of the asthma attack and the degree of asthma severity ($p < 0.05$).

In the study model (logistic regression), when the test of independence was carried out by cross-referencing the duration of emergency room visits and the other variables separately, it was found that only the intensity of the asthma attack and the degree of asthma severity remained in the model, being related to the duration of the visit.

In the logistic regression analysis, we observed that the risk of being released from the emergency

Table 2 - Adoption of approaches recommended in the III BCAM for the treatment of asthma attacks in children up to five years of age regarding the therapeutic resources used, Camaragibe-Brazil.

Therapeutic resources	Recommended n (%)	Not recommended n (%)	Total n (%)
Medication used	69 (28.1)	177 (71.9)	246 (100.0)
Fenoterol	246 (100.0)	0 (0.0)	246 (100.0)
Ipratropium bromide	37 (17.6)	173 (82.4)	210 (100.0)
Corticosteroid ^a	69 (50.7)	67 (49.3)	136 (100.0)
Aminophylline	0 (0.0)	4 (100.0)	4 (100.0)
Doses	34 (13.8)	212 (86.2)	246 (100.0)
Fenoterol	61 (24.8)	185 (75.2)	246 (100.0)
Ipratropium bromide	1 (0.5)	209 (99.5)	210 (100.0)
Corticosteroid ^a	44 (32.4)	92 (67.6)	136 (100.0)
Route of administration ^b	76 (55.9)	60 (44.1)	136 (100.0)
Nebulization procedure ^c	33 (13.4)	213 (86.6)	246 (100.0)

^aThe corticosteroid available in the emergency room was dexamethasone (in suspension or injectable), whose doses were estimated to be equivalent to the recommended doses of prednisone⁽¹⁷⁾; ^bData related to corticosteroid administration; ^cFor the nebulization procedure to be considered the recommended procedure, the use of oxygen, the control of its flow, and the intervals between nebulizations had to be in accordance with the III BCAM.

Table 3 - Distribution of the variables regarding the length of time each child spent in the emergency room, Camaragibe-Brazil.

Variable	Length of time spent in the emergency room		p value
	As recommended n (%)	Not as recommended n (%)	
Type of asthma/degree of severity			< 0.001
Persistent/moderate or severe	51 (20.7)	21 (8.5)	
Persistent/mild	18 (7.3)	44 (17.9)	
Intermittent	11 (4.5)	101 (41.1)	
Intensity of the asthma attack			< 0.001
Serious or Very serious	28 (11.4)	12 (4.9)	
Mild or Moderate	51 (20.7)	155 (63.0)	
Use and control of oxygen flow in nebulizations			0.363
Not as recommended	49 (19.9)	115 (46.8)	
As recommended	30 (12.2)	52 (21.1)	
Corticosteroids in the first hour			0.004
Not as recommended	26 (10.6)	93 (37.8)	
As recommended	51 (20.7)	76 (30.9)	
Use of anticholinergics			0.136
Not as recommended	50 (20.3)	123 (50.0)	
As recommended	29 (11.8)	44 (17.9)	

room sooner than necessary to allow the response to the treatment to be analyzed was four times greater for children with mild persistent asthma (OR = 4.17) and fifteen times greater for children with intermittent asthma (OR = 15.65) than for children with moderate persistent asthma and those with severe persistent asthma (Table 4).

With regard to the intensity of the asthma attack, the adjusted risk of being discharged from the emergency room sooner than recommended in the III BCAM (a length of time sufficient to allow the monitoring and evaluation of the attack) was approximately two-times greater (OR = 2.56) for the 206 children (83.7%) that presented asthma attacks of mild or moderate intensity (Table 4).

Discussion

The present study sought to evaluate the use of the approaches recommended in the III BCAM in pediatric cases treated in the emergency room and its repercussions on the duration of emergency room visits. The medications and the nebulization procedures were checked.

The results reveal that, in the 246 cases surveyed, there was a slight predominance of male children, 130 (52.8%), as well as of the 0–3 years of age bracket.⁽¹⁸⁾ The asthma was classified as intermittent in 112 (45.5%) of the cases, and the intensity of the asthma attack was classified as mild or moderate in 206 (83.7%). We observe that the milder forms of presentation both of the disease and of the intensity of the asthma attack prevailed.^(18,19) These data are important for the analysis of the approach regarding the use of corticosteroids and anticholinergics in the emergency room.

The present study shows that the use of medications was in accordance with the Consensus guidelines⁽¹⁻⁴⁾ (β_2 -agonists and anticholinergics), except for the fact that xanthines, which are not recommended for use⁽¹⁻⁴⁾ in the emergency room, were used in four cases in which the children were found to be refractory to treatment and had spent more than five hours in the emergency room. It is noteworthy that the dose used was 3 mg/kg, which is the lowest therapeutic intravenous loading dose, since it was not possible to determine the serum concentrations of theophylline.⁽¹⁵⁾

Although the three groups of drugs chosen for the treatments were in accordance with the Consensus guidelines,⁽¹⁻⁴⁾ the same did not occur with regard to their form of use, such as the use of anticholinergics for mild and moderate asthma attacks, corticosteroid use in the first hour in non-corticosteroid-dependent patients, and the use of aminophylline, which were responsible for 177 (71.9%) of the non-recommended procedures.⁽¹⁻⁴⁾ There was, however, no association with the length of time each child spent in the emergency room (Table 2).

Even though β_2 -agonists were used in all cases, as recommended in the Consensus guidelines, in 185 (75.2%) of the cases, the doses were not administered at the recommended rate of 0.1 mg/kg.⁽¹⁻⁴⁾ This high number of cases in which the dose was lower than that recommended in the Consensus guidelines is probably due to the fact that the doses were determined at the rate of one drop per three kilograms of body weight, which is endorsed by some authors⁽²⁰⁾ and is in accordance with the manufacturer recommendation.⁽²¹⁾

Table 4 – Multivariate analysis of the variables studied regarding the length of time each child spent in the emergency room, Camaragibe-Brazil.

Type of asthma/degree of severity	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Moderate and Severe persistent	1.00		1.00	
Mild persistent	5.54	< 0.001	4.17	< 0.001
Intermittent	21.28	< 0.001	15.65	< 0.001
Intensity of the asthma attack				
Severe or Very severe	1.00		1.00	
Mild or Moderate	6.91	< 0.001	2.56	< 0.04
Corticosteroid in the first hour				
Not as Recommended	1.00		1.00	
As Recommended	0.44	0.004	0.78	0.49

The recommended dose⁽¹⁾ of the anticholinergic agent ipratropium bromide ranges from 250 µg to 500 µg. However, the doses were lower than 250 µg in 209 (99.5%) of the 210 cases in which this drug was used. It is important to highlight that, in 197 cases, the doses ranged from 100 to 249 µg, in consonance with the manufacturer recommendation,⁽²¹⁾ in which doses range from 0.1 a 0.25 mg for children under six years of age. Although it is recommended⁽¹⁾ that ipratropium bromide be used in combination with β_2 -agonists in serious asthma attacks, ipratropium bromide was administered to 170 children presenting mild or moderate asthma attacks, whereas 3 children presenting serious or very serious asthma attacks did not receive it.

In a study published in 1998 and involving 434 children,⁽²²⁾ it was concluded that the addition of ipratropium bromide to treat serious asthma attacks reduces the need for hospitalization significantly (from 53% to 38%). However, a quite different perspective was provided by a systematic review published in the same year.⁽²³⁾ The authors of that review evaluated four studies involving children or adolescents and did not identify any benefit of the use of ipratropium bromide in the treatment of mild or moderate asthma attacks. It is important to highlight that, in Brazil, ipratropium bromide is approximately ten times more expensive than fenoterol.⁽²⁴⁾ Therefore, it should be used judiciously in the treatment of mild and moderate asthma attacks, considering the optimization of the use of medications as well as the impact on hospital costs.

The corticosteroid available in the emergency room was dexamethasone (suspension or injectable form). In 60 (44.1%) of the 136 cases in which dexamethasone was used, the route of administration (Table 2) was not that recommended in the Consensus guidelines.⁽¹⁻⁴⁾ Intramuscular administration, which is not usually recommended for use in children, since corticosteroids with long-term release present erratic absorption and considerable individual variability when administered intramuscularly,⁽²⁵⁻²⁶⁾ was responsible for this number. In fact, only 7 children presented vomiting, which justified the use of intramuscular administration. In the other cases in which the drug was used, it could have been administered orally in accordance with the Consensus guidelines, and this could have minimized the number of invasive procedures, as well as

the costs related to materials and to the number of hours of nursing care.

The analysis of the doses of dexamethasone administered was impeded because such doses were estimated based on their equivalence to those recommended for intermediate half-life corticosteroids.⁽²⁵⁾

The doses used for pediatric patients are usually based on clinical studies involving adults, which are justified by ethical constraints on clinical research involving children. These studies are the pharmacotherapeutic basis for the estimation of pediatric doses, and it is common that doses recommended can be modified according to clinical practice. Some English-speaking authors state that the definition of the word 'children' itself can be an impediment to the estimation of therapeutic doses since the term would include all individuals from newborns to adolescents. Therefore, in the attempt to guide prescriptions in clinical practice, the Licensing Medicines for Children Report of May 1996, which was based on studies carried out by the British Paediatric Association and by the Association of the British Pharmaceutical Industry, delimited the age brackets that must be considered, as well as the relationship between age and weight and, in some cases, between age and body area.⁽²⁷⁾

In 33 (13.4%) of the cases, the nebulization procedure used was in accordance with the Consensus guidelines⁽¹⁾ (Table 2). The procedure should be performed using oxygen at a minimum flow rate of 6 L/min and at 20 min intervals in the first hour of treatment.⁽¹⁾ This protocol was followed in only 83 (33.7%) of the nebulizations used for the administration of β_2 -agonists (with or without anticholinergics), although the emergency room provided resources for the use of oxygen in all of the cases. We observed that oxygen, as well as the oxygen flow rate of 6 L/min, were only used when prescribed on the patient chart.

It is essential that oxygen be used in the nebulization therapy in order to protect patients from the possible deleterious effects of the combination of hypoxemia and the use of β_2 -agonists, which can have a direct impact on the cardiovascular system.⁽²⁸⁾ In order to convert the solution into a nebulized aerosol containing particles between 2 and 4 µ, the oxygen flow rate should be between 6 and 9 L/min.⁽²⁹⁾

The protocol of three nebulizations at 20 min intervals in the first hour was followed in 33 (13.4%)

of the cases, in which cases the procedure was properly prescribed. In the other 213 procedures (86.6%), the intervals between nebulizations varied in duration.

Table 3 shows that, in the less critical presentations in terms of the type of asthma and the intensity of the asthma attack, represented respectively by 101 cases of intermittent asthma (41.1%) and by 155 cases of mild or moderate asthma attacks (63%), in which the duration of the emergency room visit was not in accordance with the III BCAM, the result was essentially determined by the non-monitoring of the child for at least an hour after a good response to the treatment instituted. This "early" discharge from the emergency room may result in frequent subsequent emergency room visits or even in the "underestimation" of the child asthma attack on the part of the family, which makes it difficult to identify any signs of worsening at home.

In the more critical clinical situations – in 51 cases of patients with moderate or severe persistent asthma (20.7%) and in 28 cases of serious or very serious asthma attacks (11.4%) – the III BCAM parameters were observed in terms of the duration of the emergency room visits. These differences were statistically significant (Table 3).

Corticosteroid use in the first hour of treatment was found to be associated with the duration of emergency room visit since corticosteroid use in the emergency room is possibly related to more serious crises, in which the results regarding the observation of the approaches recommended in the Consensus guidelines were better (Table 3). This result was statistically confirmed ($p = 0.004$).

A recent study⁽³⁰⁾ reported the results of the implementation of a protocol for the emergency room treatment of adults with asthma attacks. Despite the positive effects of this protocol on the treatment given to patients, which led to an increase in the use of peak expiratory flow determination, pulse oximetry, administration of three nebulizations in the first hour of treatment, and oral corticosteroid therapy, there was no significant effect on the duration of emergency room visits or on the rates of admission and discharge.

It should be stressed that there were deficiencies in the emergency room that might have hindered the adoption of the approaches recommended in the III BCAM, such as the lack of a pulse oximeter for the objective evaluation of the treatment as

well as the non-availability of the corticosteroid recommended.

The staff of emergency rooms includes multidisciplinary teams, of which specialists are not necessarily part. In emergency rooms, the adoption of treatment guidelines can be a facilitator for work in an environment where the routine frequently includes work overload, need for quick decision making, lack of standardization of procedures, and limited communication among the various members of the team.

Systematic protocols for the treatment of asthma attacks in the emergency room can contribute to the process of continuing education, with the objective of improving the quality of health care. It should also be borne in mind that the time saved in making certain decisions can be important for a holistic, humanized treatment of patients. Protocols should include some educational measures designed to reduce the number of visits to the emergency room, which, for asthma patients, is quite often the entryway – or the only means of access – to health care.⁽¹⁴⁾

The length of time children with mild asthma attacks and those with moderate asthma attacks spent in the emergency room was shorter than that recommended in the III BCAM; the minimum one-hour interval after a good response to treatment required for the profile to be considered stable, thereby allowing discharge, was not observed.

In conclusion, we found that there are various obstacles to the implementation of the approaches recommended in the III BCAM. Such obstacles include limited familiarity with the Consensus guidelines on the part of the multidisciplinary team, as well as the lack of recommended material and therapeutic resources (pulse oximeters and intermediate-release corticosteroids).

We recommend that the III BCAM be more widely disseminated in academic environments and continuing education centers, as well as in emergency rooms, due to the significance of the role played by those sectors as vehicles of information transfer to multidisciplinary teams and the general population. The democratization of this information can lead to the taking of measures designed to optimize the allocation of resources, such as the purchase of the recommended medications, as well as increasing the availability of pulse oximeters and peak expiratory flow meters in emergency rooms,

all of which can ultimately improve the quality of health care.

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