Use of asthma controller drugs at admission to a pediatric pulmonology outpatient clinic

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Abstract

Objective: Inhaled corticosteroids are widely used in developed countries. On the other hand, due to its high cost, this kind of drug is underused in asthmatic patients living in developing countries. The present study aims at verifying the use of controller medication in children with moderate or severe persistent asthma at admission to a specialized outpatient facility.

Methods: Descriptive study with 560 children aged 4 to 14, with diagnosed asthma, who were admitted between April 1996 and December 2000. The patients were randomly selected.

Results: Of 560 patients, 61.8% were male; 69.5% were between 4 and 9 years old. The first acute attack occurred before the first year of life in 55.8% of the cases, and 70.5% had physician-diagnosed persistent moderate asthma. In the previous 12 months, 42.7% of the children had been admitted to hospital and 92.7% were assisted in emergency rooms. Considering those living in the metropolitan area of Belo Horizonte, the average use of some kind of controller drug was 27.3%, and 17.1% of inhaled corticosteroids. The use of oral corticosteroids decreased from 14.3% in 1996 to 4.2% in 2000.

Conclusions: The rate of inhaled corticosteroid therapy was higher than those found in Brazilian studies and it is comparable to the results of some international studies. A decrease in the use of oral corticosteroids was also observed. Both findings may be related to the implementation of an asthma program in the public health system of Belo Horizonte, which began in 1996.


Introduction

Based on advances in knowledge about its physiopathology, the therapeutic focus on asthma has changed over the last 20 years. It is now known that the basic pathophysiological event is inflammation and there is a consensus on the indication of inhaled anti-inflammatory medication for persistent asthma, making possible effective control of its morbidity. 1-4 The great effort made to disseminate knowledge and standardize behavior by means of national and international consensus documents has been frustrated and studies provide evidence that asthma continues to be incorrectly diagnosed and treated. 5-9 The gap between acquired knowledge and its application is still large even in countries with high rates of prophylaxis. 10-12

In Brazil, asthma constitutes the third most common cause of hospitalization of children and young adults generating significant financial costs to the health service and great individual expenditure with repercussions in absenteeism from school and employment, poor physical returns and psychosocial impact. 2 Brazilian studies reveal a reduced level of inhaled corticosteroid therapy use varying...
from zero, in a pilot study performed in Belo Horizonte in the period between 1994 and 1995 to 6.0%, in the observations of Cabral et al., in 1998. Unfortunately the bibliographical review made by the authors did not identify any other studies of this subject in other Latin-American countries.

The present study had the objective of evaluating and quantifying the proportion of the use of maintenance treatments for persistent asthma before patients are admitted to a specialized clinic.

Methods

Location, period of execution and population studied

The study was realized at the Pediatric Pulmonology and Allergy Unit of the General Pediatric Center (Centro Geral de Pediatria- CGP), pertaining to the Fundação Hospitalar do Estado de Minas Gerais (FHEMIG), during the period from 04/1996 to 31/12/2000. The clientele is basically composed of children cared for by the National Health Service (Sistema Único de Saúde - SUS). From 1050 patients who were eligible for the study 560 patients were selected on a simple random basis from the first consultation.

Dynamics of the Unit

The General Pediatric Center (Centro Geral de Pediatria-CGP) is a referral center of the State Health Department (Secretaria Estadual de Saúde) which provides urgent, emergency and general clinical pediatric and sub-specialization care. The urgent care section attends to approximately 300 patients/day, the inpatients unit has 142 beds and the IDU 12 beds.

The pediatric pulmonology and allergy clinic includes the secondary care unit and has no specific connection with the clinical network operated by the municipal administration which is part of the Belo Horizonte local government asthma program. The patients that it cares for come from the urgent care section of the inpatients at the CGP itself and from the spontaneous demand of the clientele resident in the municipal region of Belo Horizonte.

The clinical team is made up of pediatricians qualified in pulmonology and allergy and resident doctors in their qualifying phase in these sub-specializations, who use standardized protocols and charts. The team adopts the criteria contained in the document entitled Global Initiative for Asthma (GINA) in which it is foreseen that the presence of a single severity parameter is sufficient to classify a patient into a given category.

Additionally, reference values for peak expiratory flow obtained by Godfrey were used and 80.0% of the given value was used as the lower limit of normality (Table 1).

Prophylactic medication

Drugs cited in the Brazilian consensus document and the GINA were considered as prophylactic medications, namely: slow-release theophylline, long-acting beta agonist, ketotifen, oral corticosteroids, inhaled corticosteroids, nedocromil, cromoglycate, leukotriene modifiers. The following were evaluated: the use of inhaled or systemic medication, regular or inter-crisis use, previous to the first consultation at the unit, and period of usage greater than 30 days.

Inclusion and exclusion criteria

Patients between four and fourteen years old were included at their first visit to the center if they resided in the metropolitan region of Belo Horizonte and had a diagnosis of moderate or severe persistent asthma. Patients were excluded if they were less than four years old, had other chronic pneumopathies or pulmonary malformations, both acquired and congenital. Those whose medical records contained insufficient information were substituted by the closest patient to the number in the random sequence.

Statistical features

A protocol produced specifically for the study was completed with information selected directly from medical records.

The sample size calculation was based on the following parameters: the number of eligible patients (total of 1,050 records), an estimate of 25% inhaled corticosteroid therapy use for an average of a year, 5.0% alpha error, 20.0% loss and margin of error plus or minus 2.0% for the proportion of prophylactic drug use for each year. The number of patients necessary was 35, 115, 115, 153 and 142 for the years 1996, 1997, 1998, 1999 and 2000 respectively. Mean, median and linear tendency chi-square distributions were calculated. The inhaled corticosteroid use variations were expressed by the calculation of the upper and lower limits of the 95.0% confidence interval.

Ethical considerations

The project was approved by the Committee for Ethics in Research of the General Pediatric Center and the Universidade Federal de Minas Gerais.
Results

Descriptive characteristics

The general characteristics of the population studied can be found in Table 2.

Sixty-one point eight percent of the 560 patients were male, corresponding to a ratio of 1.6/1. The age groups of the children included in the study show predominance between 4 and 9 years, corresponding to 69.8%, with a median of 85 months. Patients residing in Belo Horizonte represented 60.2% of the total, and the remainder came from other municipalities within the metropolitan region. It was observed that the majority of fathers were manual workers in the construction industry (40.2%), were self-employed (7.3%) or were retired (2.9%). The mothers were employed in positions such as housemaids (20.2%), were self-employed (10.4%) or were housewives/homemakers (45.5%).

Clinical and functional characteristics

The variables studied in order to define clinical and functional asthma are presented in Table 3.

Seventy-two percent of the children had crises less frequently than once a week. Nocturnal symptoms were presented in 50.7% of cases and physical activity was limited in 60.2%. School absenteeism was at 48.0% of the 212 children who attended school. In respect of the classification of severity, 70.5% of the patients presented moderate status and 29.5% severe. It was further observed that 92.0% of the children had recourse to the urgent care unit during the twelve months before their admission to the specialized clinic, and that 42.7% had been hospitalized during the same period. Measurement of peak expiratory flow rate was possible for 269 children, and between states 58.7% presented values less than 80.0% of the reference.

Table 1 - Classification of asthma severity

<table>
<thead>
<tr>
<th>Intermittent</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild persistent</td>
<td>Moderate persistent</td>
<td>Severe persistent</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>Less than once a week</td>
<td>More than once a week and less than once a day</td>
<td>Daily</td>
<td>Daily</td>
</tr>
<tr>
<td>Exacerbations</td>
<td>Short and mild</td>
<td>Affecting physical activity and sleep</td>
<td>Affecting physical activity and sleep</td>
<td>Frequent</td>
</tr>
<tr>
<td>Nocturnal symptoms</td>
<td>Less than twice a month</td>
<td>More than twice a month</td>
<td>More than once a week</td>
<td>Frequent</td>
</tr>
<tr>
<td>FEV1 or PEF*</td>
<td>≥ 80%</td>
<td>20 – 30%</td>
<td>60 – 80%</td>
<td>&lt; 60%</td>
</tr>
<tr>
<td>Variability of PEF</td>
<td>&lt; 20%</td>
<td>20 – 30%</td>
<td>&gt; 30%</td>
<td>&gt; 30%</td>
</tr>
</tbody>
</table>

* FEV1: forced expiratory volume in the first second, PEF: peak expiratory flow.

Table 2 - Descriptive characteristics of the population (n = 560)

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>346</td>
<td>61.8</td>
</tr>
<tr>
<td>Female</td>
<td>214</td>
<td>38.2</td>
</tr>
<tr>
<td>Age group at the 1st crisis (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>less than 1</td>
<td>313</td>
<td>55.9</td>
</tr>
<tr>
<td>1 - 2</td>
<td>104</td>
<td>18.6</td>
</tr>
<tr>
<td>2 - 4</td>
<td>78</td>
<td>13.9</td>
</tr>
<tr>
<td>&gt; 4</td>
<td>51</td>
<td>9.1</td>
</tr>
<tr>
<td>No data</td>
<td>14</td>
<td>2.5</td>
</tr>
<tr>
<td>Age group at the outpatient clinic admission (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - 6</td>
<td>195</td>
<td>34.8</td>
</tr>
<tr>
<td>7 - 9</td>
<td>196</td>
<td>35.0</td>
</tr>
<tr>
<td>10 - 14</td>
<td>169</td>
<td>30.2</td>
</tr>
<tr>
<td>City</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belo Horizonte</td>
<td>337</td>
<td>60.2</td>
</tr>
<tr>
<td>Others</td>
<td>223</td>
<td>39.8</td>
</tr>
<tr>
<td>Social class – father</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower lower-class*</td>
<td>190</td>
<td>50.4</td>
</tr>
<tr>
<td>Lower-class†</td>
<td>145</td>
<td>38.5</td>
</tr>
<tr>
<td>Middle-class‡</td>
<td>42</td>
<td>11.1</td>
</tr>
<tr>
<td>Classe social – mother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower lower-class*</td>
<td>271</td>
<td>76.1</td>
</tr>
<tr>
<td>Lower-class†</td>
<td>64</td>
<td>18.0</td>
</tr>
<tr>
<td>Middle-class‡</td>
<td>20</td>
<td>5.9</td>
</tr>
</tbody>
</table>

* Manual workers, self-employed without having their own business, housemaids.
† Workers receiving monthly salaries, public servants, retired.
‡ Technical level professionals.

The use of anti-inflammatory medication for asthma

Figure 1 documents the use of prophylactic medication within the population studied.
The use of some type of medication either previously, in isolation or association was observed by 25.7% in 1996, 33.9% in 1997, 26.1% in 1998, 25.9% in 1999 and 25.4% in 2000, giving a mean of 27.3% (95% CI, 23.7% to 31.3%).

In establishing parallels for the use of oral beclomethasone and prednisone on alternate days between each year of the study, levels were observed to oscillate with no statistical significance (p = 0.84) for inhaled corticosteroid therapy of 14.3%, 21.7%, 13.0%, 17.1%, 17.6% with an average of 17.1% (95% CI, 14.2% to 20.6%) and a decreasing tendency (p = 0.04) was observed for prednisone of 14.3%, 10.4%, 7.0%, 7.8%, 4.8%, for the years 1996, 1997, 1998, 1999 and 2000 respectively with an average of 7.7% (95% CI, 5.7% to 10.3%).

### Discussion

Advances in the treatment of asthma achieved since the introduction of inhaled corticosteroid therapy for the treatment of persistent asthma are proven by the reduction in hospitalization, urgent care, school absenteeism, severity and evolution.7,16-19

The present study enables the assumption that, even with existing public health service limitations, including the lack of integration of the different levels and spheres of attention, it is possible to institute activities with the objective of introducing inhaled corticosteroid therapy within the public network; an example of which is the reorganization of the public care of asthmatic children in Belo Horizonte. This program began informally in 1996 and was gradually adopted by the Municipal Health Secretariat from 1997 onwards in partnership with the Pediatric Department of the Universidade Federal de Minas Gerais and had as its axes the training of pediatricians at health centers and the free distribution of spray format beclomethasone and salbutamol and of valved spacing devices. The program prioritizes the age group of greatest morbidity, i.e. those younger than five who represent more than 75% of the infant and juvenile clientele who benefit from the program.

Within the population studied, the distribution by sex reveals a ratio of 1.6/1 male/female, which agrees with data in scientific literature which indicates a predominance of the male sex until adolescence20 and with a Brazilian study performed by Duarte and Camargos.8 The median of the ages of children admitted was observed to be 86 months.

![Figure 1](image-url)
despite the crises having their onset before 12 months in 55.8% of the children and 92.9% of them having been seen at urgent care services and 42.7% having required previous internment. These results approximate to those obtained by Cabral et al.\(^7\) which were 98.0% and 82.0%, respectively.

In order to establish a comparative analysis between this study and others into the use of inhaled medication attention should be given to the methodological differences between them such as variations in the principal objectives of the studies, the age group studied, the classification of the severity of asthma, the type of drug analyzed and the period during which the study was performed.

European countries such as Finland, Iceland, Holland, Norway and Sweden have the highest levels of inhaled corticosteroid use, as observed during the 90s (80.0%, 62.0%, 58.0%, 45.9% and 45.1%), however these studies refer to the general population and do not consider the severity of asthma.\(^{10,21,22}\) Although they have high socio-economic and cultural levels and health services of a high standard which prioritize prevention, other European countries have a smaller proportion of asthmatic patients using these medications; for example Germany (30.8%) Slovakia (39.2%).\(^{23}\) Studying 555 primary school children from Paris in 1994, Morales\(^5\) called attention to the fact that asthma was still improperly diagnosed and treated having found 14.3% prophylaxis and inhaled corticosteroid therapy usage limited to 6.3%. These studies did not take account of the severity of asthma, which limits comparison of their figures with the present study.

Research carried out in the United States call attention to large variations in the use of inhaled prophylactic medication. An evaluation across three regions, Boston (Massachusetts), Rochester (New York), and New Haven (Connecticut), in the period between 1988 and 1990 of children with undefined severity asthma found evidence of levels of inhaled cromoglycate and corticosteroid usage of 11.0%, 19.0% and 33.0%.\(^{18}\) Another study of the inner cities of seven of the largest cities in the United States, performed between 1992 and 1993 by Crain\(^{23}\) observed an average of 47.5% inhaled anti-inflammatory usage in severe asthma. The proportions of maintenance therapy use for asthma found in the studies mentioned are not comparable with those found by this study due to the different characteristics of the populations studied.

A project instigated in the Czech Republic with the objective of coordinating a strategy to tackle asthma\(^{25}\) was initiated in 1997 with primary care professionals representing 53.8% of pediatricians and 26.3% of general clinicians receiving training. The therapies prescribed in 1993 were then compared with the post-training situation in 1999 revealing a decrease of ketotifen use (44.0% to 19.0%), cromoglycate (24.0% to 5.0%) and xanthines (25.0% to 4.0%) and increased prescription of inhaled corticosteroids from 3.0% to 52.0%. Taking into account methodological differences such as the fact that the study assessed the population in general, the use of prescription records and that the clinical severity was not considered, the present study also revealed a tendency towards reduced prednisone use as a prophylactic and low levels of cromoglycate, xanthines and ketotifen use.

In Brazil, a study undertaken in the state of Ceará,\(^9\) of 960 children, of whom 23.0% has persistent, moderate or severe asthma, revealed that only 1.5% of the children used beclometasone and 5.2% cromoglycate or nedocromil. Similar proportions, 6.1% inhaled corticosteroids, were found by McGill et al.\(^6\) in Wisconsin between 1992 and 1996 in a study of underprivileged children between 3 and 5 years old. These levels are lower than those found in this study; 17.1% on average for inhaled corticosteroids. In Juiz de Fora\(^8\) levels of 4.6% of inhaled anti-inflammatory use were found, with inhaled corticosteroid therapy used by only 0.8% of the patients with persistent moderate and severe asthma. Levels of inhaled prophylaxis lower than those observed in Belo Horizonte were also found by Cabral et al.\(^7\) in the municipality of São Paulo who observed inhaled corticosteroid therapy use by only 6.0% of the patients. Taking into account the data from international and domestic studies, inhaled prophylaxis levels in this study are at an intermediate level. Nevertheless, the levels of coverage remain low showing that the asthma control program initiated in Belo Horizonte ought to amplify its coverage to those over five years old.

Notwithstanding the socio-economic and cultural characteristics of the population studied and the limits of the asthma program, it is observed that the use of maintenance medication is around 17% over the five years of the study, despite annual variations such as that detected during the period 1997-1998. Extra-official information obtained by the authors reveals the occurrence of irregular inhaled corticosteroid supply during these two years due to operational and administrative reasons.

After the project was initiated the training of pediatricians working in health centers operated by the municipal authorities which are also connected, directly or indirectly, with other urgent care and emergency services within the metropolitan region of Belo Horizonte, including the CGP, may have contributed to the levels encountered and to the changes to the profile of treatment such as the consistent and progressive reductions in the use of systemic corticosteroid therapy. However, limitations which are probably related to the protocol used in this study do not permit the authors to interpret in greater detail the relative disproportionality between the decreased used of systemic and increased use of inhaled medication.

It can therefore be proven that, even in developing countries, in which the deficiencies of the public health service are clearly recognized, it is possible to achieve levels which are minimally satisfactory of asthma maintenance treatment coverage. The continuous training of health personnel, the further integration of primary and tertiary care units in order to assure continuity of treatment after hospital discharge, the emphasis on educative programs...
and on self-help associated with the free and regular supply of inhaled corticosteroids are fundamental to the theoretic knowledge publicized by consensus documents achieving its practical objective.

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