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Pediatricians' Attitude in Management of Acute Bronchiolitis: Did Guidelines Overcome Practices?

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Background: Acute bronchiolitis is one of the most common diseases of early childhood. There are many recent changes in the treatment of acute bronchiolitis. The aim of this study is to evaluate treatment approaches to acute bronchiolitis among clinicians and to observe compliance with clinical guidelines.
Materials and Methods: Our study was designed as a multicenter cross-sectional descriptive study. A cohort of pediatric residents, fellows, and attendants were surveyed with a questionnaire including general and occupational characteristics of pediatricians and treatment choices in acute bronchiolitis.
Results: A total of 713 questionnaires were collected. Most commonly applied treatment among pediatricians was inhaled salbutamol, followed by intravenous hydration, hypertonic saline, and inhaled steroid. Most commonly preferred treatment in the management of mild bronchiolitis was oral hydration and inhaled salbutamol in severe bronchiolitis.
Conclusion: Although recent guidelines for the treatment of acute bronchiolitis does not support the use of many different therapies, pediatricians still tend to use them, especially bronchodilators, corticosteroids, and antibiotics.

Keywords: bronchiolitis, treatment, infant, children, guideline

Introduction

Acute bronchiolitis is one of the most common infections of early childhood, 2%–3% of children under 1 year are hospitalized with a diagnosis of acute bronchiolitis resulting in significant mortality and morbidity especially in the developing countries. Hospital charges reach billions of dollars annually in the developed countries.[1,2] Viruses especially respiratory syncytial virus is the most common pathogen, causing inflammatory cell infiltration, edema, mucous secretion, and impaired ciliary function leading to obstruction of small airways and clinical manifestations of cough, tachypnea, wheezing, grunting, and retractions.[1,2]

Curative therapy of acute bronchiolitis is not present. Therefore different therapeutic options of bronchiolitis focus on decreasing respiratory symptoms and relieve the obstruction. Although numerous therapies including bronchodilators, steroids, antibiotics, hypertonic solutions, and respiratory support devices are being used widely, no available therapy could shorten the normal course of bronchiolitis symptoms that last 2 weeks on average.[1,2] To improve the management of bronchiolitis and standardize therapy in

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children, different guidelines have been developed and implemented.[3–6] American Academy of Pediatrics published one of the most influential guideline on clinical practice of bronchiolitis in 2006 and updated in 2014.[3,6] These clinical practice guidelines provides evidence-based recommendations on the diagnosis and management of bronchiolitis in infants less than 2 years of age.[3] According to this guideline, commonly used therapies including bronchodilators, steroids, and antibiotics should not be used in treatment of bronchiolitis and supportive therapies including hydration and oxygen therapy in hypoxemic children should be the mainstay of treatment.[3] Despite this evidence based guidelines, management of bronchiolitis widely varies among in pediatricians.[3]

The objective of this study was to evaluate treatment preferences of pediatricians for children with acute bronchiolitis and to determine compliance with clinical guidelines.

Materials and Methods

This study was designed as a multicenter cross-sectional descriptive survey study. The survey was developed via the consensus of the study authors as an anonymous, self-completion questionnaire (Appendix A1). Authors contacted 15 members of Pediatric Emergency and Intensive Care Society working in four different regions of Turkey and requested them to send questionnaires to all pediatricians working at the same hospital. All members were informed about purpose and details of the survey study. Physicians other than pediatricians including family physicians, practitioners, and adult emergency medicine physicians were excluded from the study. If the members were willing to participate in the survey study, questionnaires were delivered by mail and recruited by the same method. In December 2016, the survey was sent to all members and recruited in the following 6 months. This study was approved by the Hacettepe University Institutional Ethics Committee.

The questionnaire consisted of three main domains (Appendix A1):

(1) General demographic and working place characteristics including age, gender, present hospital s/he is working, present duty in working place, total working time as a pediatrician, presence of subspeciality, and the number of patients with bronchiolitis s/he sees in a year.
(2) Daily practices about management of patients with acute bronchiolitis.

Frequency of utilization of different treatment choices including inhaled/oral salbutamol, inhaled hypertonic saline, inhaled adrenaline, inhaled/oral/intravenous steroids, inhaled ipratropium bromide, inhaled/intravenous magnesium sulfate, intravenous hydration, oral/intravenous antibiotics, and high frequency nasal oxygenation was scored on a 5-point scale (always, usually, sometimes, only in high-risk patients, and never). For the interpretation of the results, we considered ''always'' or ''usually'' as ''frequent'' performance of an item and ''only in high-risk patients'' or ''never'' as ''rarely'' performance of an item. Assessment of a patient as high risk solely depends on the clinical judgment of the physician.

(3) Initial preference of therapy/therapies in patient with mild and severe bronchiolitis.

Data analysis was performed using SPSS 17.0 statistical program. Descriptive analysis was presented with frequencies and percentages for discrete variables and mean and standard deviation for continuous variables. For further analysis, a cohort was subgrouped according to type of hospital, duty in the hospital, total duration of working as a pediatrician, and number of bronchiolitis patients seen in a year. Discrete variables of two groups were compared by Pearson chi-square test and Fisher's exact test. Continuous variables were compared by student *t*-test and one way ANNOVA test. $p < 0.05$ was considered statistically significant for all tests.

Results

A total of 713 responders participated in the survey and response rate was 78%. Mean age of responders was 32.5 ± 7.0 years, mean duration of working time was 3.9 ± 5.2 years. The distribution of responders was residents (58.6%), specialists (34.6%), and lecturers (5.8%). General characteristics of participants are shown in Table 1.

Overall, the most common therapy used in bronchiolitis was inhaled salbutamol (79.8% of pediatricians). Other frequently used therapies were as follows: intravenous hydration (39.4%), inhaled steroid (29.4%), inhaled hypertonic saline (26.3%), and inhaled adrenalin (20%). Intravenous steroid (19.5%) and oral steroid (12.7%) were also given but less than inhaled route (29.4%). Intravenous route was preferred more by pediatricians working at a public hospital and oral route by pediatricians working at a university hospital. Oral salbutamol was rarely preferred, 52.7% of the pediatricians stated that they never give oral salbutamol treatment. But it was preferred more by pediatricians working at a public hospital and by pediatricians who have worked longer ($p < 0.05$).

Nearly one-third of pediatricians (28.5%) stated that they chose high flow nasal oxygenation in high-risk patients, pediatricians with subspecialities chose this treatment modality more frequently ($p < 0.05$).

Antibiotic treatment was sometimes preferred (oral 36.7% and intravenous 26.1%). Antibiotics were preferred less by pediatricians with subspecialties ($p < 0.05$).

Treatment modalities that were rarely or never given were inhaled ipratropium bromide, inhaled magnesium sulfate, and intravenous magnesium sulfate. Intravenous magnesium sulfate was preferred by pediatricians working at a university hospital ($p < 0.05$). Responses of participants are shown in detail in Table 1.

Treatment choices of pediatricians also changed significantly according to frequency of bronchiolitis patients they see in a year. Pediatricians who treat <10 bronchiolitis patients in a year preferred more oral antibiotics and less intravenous magnesium sulfate and pediatricians who treat >10 patients in a year more commonly preferred intravenous hydration ($p < 0.05$).

In the management of mild bronchiolitis, the most commonly preferred type of treatment was oral hydration (60.2%) followed by inhaled salbutamol treatment at hospital (49.8%) or at home (43.8%). Watchful waiting without treatment was preferred almost by one-third of pediatricians (28.8%), more commonly by pediatricians with subspecialities ($p < 0.05$). Other treatment options were preferred infrequently; inhaled steroid treatment at home (13%) or at hospital (7.6%), intravenous steroid treatment (5.2%), and

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Table. 1. General Characteristics and Treatment Choices of Participants

Characteristics of participants	n *(%)*
Gender	
Female	453 (63.5)
Academic degree	
Residents	418 (58.6)
Specialists	247 (34.6)
Lecturer	41 (5.8)
Hospital s/he works	
Public hospital	331 (46.4)
University hospital	361 (50.6)
Number of bronchiolitis patients seen in a year	
<10 patients	58 (8.1)
10–50 patients	209 (29.3)
>50 patients	431 (60.4)

Treatment choices	*Always (%)*	*Usually (%)*	*Sometimes (%)*	*High-risk patients (%)*	*Never (%)*
Inhaled salbutamol	305 (42.8)	264 (37)	92 (12.9)	26 (3.6)	9 (1.3)
Oral salbutamol	9 (1.3)	32 (4.5)	128 (18)	12 (1.7)	376 (52.7)
Inhaled steroid	51 (7.2)	158 (22.2)	216 (30.3)	79 (11.1)	144 (20.2)
Oral steroid	13 (1.8)	78 (10.9)	184 (25.8)	112 (15.7)	231 (32.4)
Intravenous steroid	17 (2.4)	122 (17.1)	222 (31.1)	201 (28.2)	89 (12.5)
Inhaled hypertonic saline	38 (5.3)	150 (21)	216 (30.3)	59 (8.1)	155 (21.7)
Inhaled adrenalin	21 (2.9)	122 (17.1)	259 (36.3)	120 (16.8)	138 (19.4)
Inhaled ipratropium bromide	24 (3.4)	101 (14.2)	264 (37)	88 (12.3)	96 (13.5)
Inhaled magnesium sulfate	1 (0.1)	6 (0.8)	84 (11.8)	112 (15.7)	365 (51.2)
Intravenous magnesium sulfate	1 (0.1)	15 (2.1)	118 (16.5)	266 (37.3)	185 (25.9)
Oral antibiotics	21 (2.9)	107 (15)	262 (36.7)	108 (15.1)	155 (21.7)
Intravenous antibiotics	9 (1.3)	76 (10.7)	186 (26.1)	156 (21.9)	146 (20.5)
Intravenous hydration	91 (12.8)	190 (26.6)	216 (30.3)	83 (11.6)	25 (3.5)
High frequency nasal oxygenation	27 (3.8)	101 (14.2)	185 (25.9)	203 (28.5)	74 (10.4)

oral steroid treatment (5.2%) were rarely preferred in the management of acute mild bronchiolitis. Inhaled steroid was more commonly preferred by pediatricians who worked longer ($p < 0.05$).

In the management of severe bronchiolitis, the most commonly preferred type of treatment was inhaled salbutamol (86.7%), especially by pediatricians working at a public hospital and by pediatricians whose working time is longer ($p < 0.05$). Most of the pediatricians preferred to hospitalize these patients (73.8%). More than half of pediatricians applied high flow nasal oxygenation (60.7%) and intravenous steroids (57.6%). Inhaled adrenalin (44%), inhaled ipratropium bromide (42.1%), and intravenous magnesium sulfate (33.8%) were also commonly preferred in treatment of severe bronchiolitis patients especially by pediatricians at a public hospital. Inhaled hypertonic saline (37.2%) and inhaled steroid (33.9%) were also commonly preferred in management of acute severe bronchiolitis. Pediatricians infrequently preferred positive pressure ventilation (PPV) (19.9%), oral steroid (17.4%), and inhaled magnesium sulfate (15.1%) in treatment of severe bronchiolitis. PPV was commonly preferred by pediatricians at a university hospital. Inhaled magnesium was less commonly preferred by pediatricians whose total working time is longer ($p < 0.05$).

Discussion

Our study identifies pediatricians' attitude in the management of acute bronchiolitis and differences of treatment choices in our cohort. Our results showed that most common therapies used in the management of acute bronchiolitis were inhaled salbutamol, inhaled hypertonic saline, hydration, and inhaled steroids. Pediatricians prefer to give inhaled salbutamol and oral hydration in the management of mild bronchiolitis and intravenous steroids and high flow nasal oxygenation in addition to inhaled salbutamol in severe bronchiolitis and hospitalize these patients.

When we compare our results with current literature and guidelines, we observed an extensive use of inhaled salbutamol in our cohort, although current guidelines recommend pediatricians not to administer salbutamol or albuterol in the management of acute bronchiolitis. Even if these medications can transiently improve clinical scores, they do not effect disease resolution, need for hospitalization, or length of stay.[6–8] However there are big differences in clinical practice. Some studies that were conducted after implementation of American Academy of Pediatrics guidelines comparing therapies that were used before and after guidelines showed a significant decrease both in frequency of use and in dose of bronchodilators, although sometimes pace of decrease is slow but steady.[9–14] However, there are also some studies with contrary results, Johnson et al. showed that bronchodilators were being used in 53% of patients without decrease after the implementation of 2006 guidelines.[15] Florin et al. also showed that utilization of albuterol and adrenaline did not change after publication of guidelines causing increased length of stay.[15,16] Therefore, guideline recommendations of not using albuterol or salbutamol treatment could not be adapted completely to clinical practice, probably due to transient clinical improvement on using

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these treatments or due to reluctance to give up a treatment practice that has been successful in some patients or due to lack of motivation to change, as Rodriguez-Martinez et al. suggested.[17] Underlying reasons for failure to follow recommendations should be investigated with further studies.

Corticosteroids once have been used in management of acute bronchiolitis for a long time for anti-inflammatory effect. But recent guidelines also advised not to use corticosteroids, because clear clinical benefit of corticosteroid treatment has not been shown and also it can result in short-term adverse effects and prolongation of viral shedding.[3,6] Our results show that although infrequently, pediatricians still use corticosteroid treatment in management of patients with bronchiolitis; nearly one-third of pediatricians (29.4%) declared that they always or usually use inhaled steroids in the treatment of acute bronchiolitis, 19.5% use intravenous steroids, 12.7% use oral steroids, and 17% of pediatricians give steroids even if bronchiolitis was evaluated as mild clinically. Corticosteroid treatment frequency is higher in our cohort than most of other studies, most studies in literature showed that there is a significant decrease in utilization of steroids after implementation of guidelines around 10%–15% percent, in a study of Barben et al., it is below 10%.[9,11,12,14,16] Therefore, efforts should be made to reduce unnecessary utilization of corticosteroid treatment in our study cohort. As such, antimicrobials were also not advised in guidelines unless there is a concomitant bacterial infection, but in our study population, one-third of pediatricians sometimes preferred to use antibiotics in management of acute bronchiolitis, especially the pediatricians without subspecialities and who treat less than 10 bronchiolitis patients per year. Therefore, antibiotic treatment should also be decreased in our study group especially in certain subgroups to decrease unnecessary admissions and costs.

Hydration and inhaled hypertonic saline are recommended under certain circumstances in guidelines,[3] which are also preferred by pediatricians in our study group. Oral hydration in mild bronchiolitis is commonly preferred, hypertonic saline is commonly used in severe bronchiolitis. Another therapy that was mentioned in guidelines but not recommended as lack of strong evidence in guidelines is high flow nasal oxygen therapy that is often preferred in high-risk patients and in severe bronchiolitis in our study group, especially by pediatricians with subspecialities.[3]

In the study of Johnson et al., it was argued that treatment choices can vary between different sites.[15] Several studies also showed that there are significant treatment differences between geographic regions and even between several sites in the same region most probably due to local guideline differences and hospital policies.[12–16,18–20] Results of our study also showed that treatment choices differ among pediatricians working in different hospitals. Pediatricians working at a university hospital tend to give salbutamol less and give inhaled salbutamol at home instead of hospital in patients with mild bronchiolitis and pediatricians with subspecialties prefer to follow patients with acute bronchiolitis without medical treatment instead of inhaled salbutamol treatment. These differences should be considered when implementation of guidelines was aimed.

Results of our study showed that even though pediatricians are aware of treatment changes in acute bronchiolitis, they are somehow unwilling to change their clinical practice especially when they treat few bronchiolitis patients in a year or they do not specialize in bronchiolitis treatment. Studies in literature showed that there are several boundaries for reluctance to change, guidelines are not sufficient for change, pediatricians have difficulties to incorporate evidence into daily practice and they do not want to give up a treatment that they observed to be beneficial in some patients.[17,18] In addition to that, improving knowledge does not always alter the behavior, pediatricians have their own beliefs and practices and it can be difficult to observe patients without treatment and suppress the need ''to do something.''[14] Other reasons could be inadequate information about recent changes and ineffectiveness of passive dissemination of findings and lack of local briefings.[14,18] There are several methods to overcome these barriers, first of all there should be some dedicated individuals in every institution eager to lead the change.[14,15,18] Directors of institutions should also support change and give necessary instructions for that.[11,15] A team with members from different disciplines who would start and continue implementation process should be gathered together and this team should always be in touch, monthly meetings should be arranged to review process and to discuss barriers and solutions.[11,12] Local guidelines and education programs should be prepared.[9,12,14,18] There can be ready order sets for bronchiolitis to improve pediatricians' workflow.[11,12] Family education leaflets can be prepared to overcome barriers in families' perception of bronchiolitis treatment.[14]

There are several limitations to this study. First of all, only the pediatricians that we could reach and who are willing to fill the forms were included in the study, and this could have caused a selection bias, pediatricians who think that they lack enough information about recent developments in acute bronchiolitis treatment would have refused to participate. Second, treatment choices of pediatricians could be different in acute viral bronchiolitis and recurrent bronchiolitis but it was not specified in our study. Third, the survey did not include questions about participants' knowledge about guidelines and barriers against the use of them. This knowledge could have helped us to develop strategies to change clinical practice.

Conclusion

Although recent management guidelines of acute bronchiolitis does not support the use of many different therapies, especially bronchodilators, corticosteroids, and antibiotics, pediatricians still tend to use them in Turkey. More studies are needed for assessing the effect of different interventions to change daily practice among in pediatricians who manage patients with acute bronchiolitis.

Author Disclosure Statement

No competing financial interests exist.

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Appendix A1. Management of Acute Bronchiolitis Questionnaire

Age:
Gender: ☐ Male ☐ Female
Present city you are living in:
Present duty in working place

☐ General practitioner:
- ☐ Family physician
- ☐ Pediatric resident (……years)
- ☐ Pediatric fellow (……years) subspecialty:
- ☐ Pediatric specialist (……..years) subspecialty:
- ☐ Lecturer (……years) subspecialty:
- ☐ Other (……)

Present hospital you are working:

☐ State hospital
☐ Training and research hospital
☐ University hospital
☐ Private hospital
☐ Other (……)

Present work place:

☐ Pediatric emergency department
☐ Pediatric oupatient clinic
☐ Pediatric ward
☐ Pediatric intensive care unit
☐ Other (……..)

(*Appendix continues* →)

How many bronchiolitis patients do you treat in one year?

☐ None
☐ Less than 10 patients a year
☐ 10-50 patients a year
☐ More than 50 patients a year

Which treatments do you prefer in management of acute bronchiolitis?

	Always	*Usually*	*Sometimes*	*Only in high-risk patients*	*Never*
Inhaled salbutamol					
Oral salbutamol					
Inhaled steroid					
Oral steroid					
Intravenous steroid					
Inhaled hypertonic saline					
Inhaled adrenalin					
Inhaled ipratropium bromide					
Inhaled magnesium sulfate					
Intravenous magnesium sulfate					
Oral antibiotics					
Intravenous antibiotics					
Intravenous hydration					
High frequency nasal oxygenation					

Which treatment/s do you prefer in patients with *mild bronchiolitis?* (You can check more than one option)

☐ Inhaled salbutamol at hospital
☐ Inhaled salbutamol at home
☐ Inhaled steroids at hospital
☐ Inhaled steroids at home
☐ Oral steroids
☐ Intravenous steroids
☐ Oral hydration
☐ Watchful waiting without treatment
☐ Other(……)

Which treatment/s do you prefer in patients with *severe bronchiolitis*? (You can check more than one option)

☐ Inhaled salbutamol
☐ Inhaled steroids
☐ Oral steroids
☐ Intravenous steroids
☐ Inhaled adrenalin
☐ Inhaled hypertonic saline
☐ Inhaled ipratropium bromide
☐ Inhaled magnesium sulfate
☐ Intravenous magnesium sulfate
☐ High flow nasal oxygenation
☐ Positive pressure ventilation
☐ Admission to hospital
☐ Other (……)

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