

PEDIATRIC ASTHMA

Management Preferences of Pediatricians in Moderate and Severe Acute Asthma

MUSTAFA ARGHA, M.D.,^{1,*} ARZU BAKIRTAS, M.D.,¹ FERHAT CATAL, M.D.,¹ OKSAN DERINOZ, M.D.,²
ERDEM TOPAL, M.D.,¹ M. SADIK DEMIRSOY, M.D.,¹ AND IPEK TURKTAS, M.D.¹

¹Department of Pediatric Allergy and Asthma, Gazi University Faculty of Medicine, Ankara, Turkey.

²Department of Pediatric Emergency, Gazi University Faculty of Medicine, Ankara, Turkey.

Objective. To assess and compare management preferences of physicians for moderate and severe acute asthma based on case scenarios and to determine the factors influencing their decisions. **Methods.** A questionnaire based on the Global Initiative on Asthma (GINA) guideline and comprising eight questions on management of acute asthma was delivered to participants of two national pediatric congresses. Management of moderate and severe acute asthma cases was evaluated by two clinical case scenarios for estimation of acute attack severity, initial treatment, treatment after 1h, and discharge recommendations. A uniform answer box comprising the possible choices was provided just below the questions, and respondents were requested to tick the answers they thought was appropriate. **Results.** Four-hundred and eighteen questionnaires were analyzed. All questions regarding moderate and severe acute asthma case scenarios were answered accurately by 15.8% and 17.0% of physicians, respectively. The initial treatment of moderate and severe cases was known by 100.0% and 78.2% of physicians, respectively. Knowledge of the appropriate plan for treatment after 1h was low both for moderate (45.0%) and severe attacks (35.4%). Discharge recommendations were adequate in 32.5% and 70.8% of physicians for moderate and severe attacks, respectively. Multiple logistic regression analysis revealed that working at a hospital with a continuing medical education program was the only significant predictor of a correct response to all questions regarding severe attacks ($p = .04$; 95%CI, 1.02–3.21). No predictors were found for information on moderate attacks. **Conclusions.** Pediatricians have difficulty in planning treatment after 1 hour both for moderate and severe asthma attacks. Postgraduate education programs that target physicians in hospitals without continuing medical education facilities may improve guideline adherence.

Keywords acute asthma, case scenario, guidelines, management, physician

INTRODUCTION

Acute asthma is the most important cause of preventable mortality and morbidity in patients with asthma (1–3). Not only patients' adherence to treatment, but also physicians' adherence to asthma guidelines may play a role in increased exacerbation frequency, number of emergency department visits, hospitalization rates, and medical costs (4, 5). Therefore, asthma guidelines are continuously revised to improve management strategies, increase the quality of life of patients, and decrease the socioeconomic burden of the disease by incorporating updated scientific information (1–3).

Treatment of mild asthma attacks is simple, being only administration of inhaled short-acting β_2 -agonists (SABA). Therefore, mild attacks are usually managed at home (1–3). However, most patients with moderate and severe asthma attacks present to the emergency department (ED) for treatment. The acute asthma management algorithms presented in the various asthma guidelines are almost identical, and all recommend tailoring treatment according to the response to initial treatment at the ED (1–3). However, physicians' management practices for acute asthma deviate substantially from the recommendations in guidelines (5–11). In this respect, moderate and

severe asthma attacks are the most costly episodes. To our knowledge, no study to date has compared the moderate and severe asthma attack management preferences of the same physician. On the other hand, investigation of this issue in routine clinical practice is difficult. Thus, case scenarios and related clinical questions regarding management of moderate and severe acute asthma episodes may provide useful information. Therefore, we aimed to assess and compare the management preferences of physicians for moderate and severe acute asthma based on case scenarios and to determine the personal factors that influence their decisions. We hypothesized that the management preferences of physicians differ for moderate and severe acute asthma beyond initial treatment with SABAs.

METHODS

The questionnaire was constructed by the authors (three pediatric allergists and one pediatric ED physician) according to statements of the GINA guidelines (1). It was composed of two parts: the first comprised demographic features of physicians, such as age, sex, duration as a physician, title, work place, and working unit. The second part included two clinical case scenarios (one was a moderate and the other a severe acute asthma case) and eight questions relevant to these cases (Appendix 1). These questions aimed to evaluate the physicians' ability to

*Corresponding author: Mustafa Arga, M.D., Department of Pediatric Allergy and Asthma, Gazi University Faculty of Medicine, 06510 Besevler, Ankara, Turkey; Tel: +90 312 2025103; Fax: +90 312 2150143; E-mail: mustafarga@gmail.com

identify the severity of an acute attack, begin accurate initial treatment, tailor a further treatment plan according to the patient's response to the initial treatment, and make discharge recommendations. A uniform answer box including the possible choices was provided immediately below the questions, and respondents were requested to tick those they thought was appropriate. They were informed that they could tick more than one choice.

The responses of the physicians to each question were categorized according to guideline recommendations. When the preference and/or preferences of the physician included all of the recommendations of relevant guidelines, the response was defined as accurate treatment. When the preference and/or preferences of the physician included extra suggestions in addition to guideline recommendations, it was defined as overtreatment. When one or more recommendations were missing, it was defined as undertreatment. In one-best-answer questions, responses that were in harmony with guideline recommendations were defined as correct; those that were not in harmony with guidelines were defined as incorrect.

The study population comprised participants attending annual congresses of the Turkish Pediatric Association and Society of Pediatric Emergency and Intensive Care Medicine in Turkey. The survey instrument was delivered as a printed sheet to the participants during the congresses at the registration desk. The questionnaires filled out by pediatric allergists and/or pulmonologists were excluded.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software, version 11.5 (SPSS Inc., Chicago, IL, US). The Shapiro–Wilks test was used to evaluate the normality of distributions. Normally distributed variables were expressed as means (SD). Categorical variables were shown as percentages and analyzed using the chi-square test. Within-group comparisons for moderate and severe acute asthma scenarios were made by the McNemar test. Multiple logistic regression analyses were used to control for all potential confounding factors to determine the predictors of management of acute asthma. The level of statistical significance was set at $p < .05$.

RESULTS

We delivered one thousand questionnaires in two congresses. Four-hundred and thirty-five questionnaires were returned. Among them, 418 in which all questions were answered were included in the analysis. The characteristics of the respondents are summarized in Table 1.

All questions about moderate and severe acute asthma case scenarios were answered accurately by 15.8% and 17.0% of physicians, respectively. Only 19 (4.5%) respondents gave accurate answers to all of the questions related to both case scenarios.

When answers to questions about determination of severity of acute asthma, planning the initial treatment,

TABLE 1.—Characteristics of the study group ($n = 418$).

	<i>n</i> (%)
Female/Male	235/183
Age, years (mean $\pm$ SD)	34.3 $\pm$ 7.1
Duration working as a physician	
< 10 years	241 (57.7)
> 10 years	177 (42.3)
Specialty	
General practitioner	17 (4.1)
Resident in pediatrics	174 (41.6)
Pediatrician	227 (54.3)
Workplace	
Hospital	162 (38.8)
Training hospital ^a	74 (17.7)
University hospital ^a	114 (27.3)
Outpatient clinic	68 (16.3)
Working units	
Emergency/intensive care unit	46 (11.0)
General outpatient unit	92 (22.0)
General inpatient unit	280 (67.0)

Note: ^aContinuing medical education program.

the treatment plan after 1h, and discharge recommendations between the moderate and severe attack case scenarios were compared, accurate response rates differed significantly between case scenarios ($p < .001$ for all question pairs).

Physicians' working unit (emergency department/intensive care, general pediatric outpatient or inpatient clinics) did not make any difference considering accurate response rates neither in moderate ($p = .323$) nor in severe ($p = .880$) or in both case scenarios ($p = .150$).

Multiple logistic regression analysis was performed to identify the effects of potential personal factors of physicians, such as age, gender, experience, working place, and working unit, on correct response rates. No personal predictor factors that influenced the physicians' accurate responses to a moderate asthma attack could be identified. Working at a hospital with a continuing medical education program was the only significant predictor of an accurate response to all questions in the severe attack case scenario ($p = .04$; 95%CI, 1.02–3.21).

Identifying the Severity of Acute Asthma (Questions 1 and 5)

The number of physicians that accurately identified the severity of acute asthma in both case scenarios was 220 (52.6%). Physicians' ability to recognize the severity of an acute asthma episode differed between the moderate and severe acute asthma case scenarios ($p < .001$) (Table 2).

Initial Treatment Plan of Moderate and Severe Acute Asthma (Questions 2 and 6)

Three-hundred and twenty-seven physicians (78.2%) knew the initial treatment in both case scenarios. The initial treatment choices of physicians to moderate and severe acute asthma are shown in Table 2.

None of the physicians who recommended systemic corticosteroids in addition to SABA and oxygen in the

TABLE 2.—Distributions of answers to questions regarding the management of moderate and severe acute asthma cases.

	Case 1 Moderate acute asthma <i>n</i> (%)	Case 2 Severe acute asthma <i>n</i> (%)	<i>p</i>
Questions 1 and 5 (severity of acute asthma)			
Mild acute asthma	108 (25.8)	—	
Moderate acute asthma	258 (61.7)	12 (2.8)	<0.001
Severe acute asthma	52 (12.5)	306 (73.2)	<0.001
Life-threatening acute asthma	—	100 (24.0)	
Questions 2 and 6 (initial treatment)			
Accurate treatment	418 (100.0)	327 (78.2)	<0.001
100% oxygen	418 (100.0)	418 (100.0)	
SABA	418 (100.0)	391 (93.5)	
Systemic corticosteroid [†]		354 (84.7)	
Undertreatment		91 (21.8)	NA
100% oxygen	—	—	
Only SABA		64 (15.3)	
Only inhaled ipratropium bromide		27 (6.5)	
Overtreatment	163 (39.0)	84 (20.1)	0.014
Add systemic corticosteroid [‡]	93 (22.3)		
Add inhaled ipratropium bromide	66 (15.8)	50 (12.0)	
Add intravenous magnesium sulfate	4 (0.9)	56 (13.4)	
Add inhaled corticosteroid	—	—	
Add LTRA	—	—	
Questions 3 and 7 (treatment after 1 h)			
Accurate treatment	188 (45.0)	148 (35.4)	0.004
100% oxygen	418 (100.0)	418 (100.0)	
SABA	418 (100.0)	418 (100.0)	
Systemic corticosteroid	288 (68.9)	418 (100.0)	
Inhaled ipratropium bromide	317 (75.8)	352 (84.2)	
Intravenous magnesium sulfate [†]		180 (43.1)	
Undertreatment	230 (55.0)	—	NA
Only add systemic corticosteroid	130 (31.1)		
Add inhaled corticosteroid + inhaled ipratropium bromide	85 (20.3)		
Only add inhaled ipratropium bromide	15 (3.6)		
Overtreatment	—	270 (64.6)	NA
Add inhaled corticosteroid		194 (46.4)	
Add LTRA		110 (26.3)	
Emergency room treatment	319 (76.3)	—	
Hospitalization	99 (23.7)	418 (100.0)	
Question 4 (Discharge recommendations from ED)			
Accurate treatment	136 (32.5)		<0.001*
SABA	357 (85.4)		
Systemic corticosteroid	136 (32.5)		
Undertreatment	43 (10.3)		NA*
Only SABA	42 (10.1)		
Only systemic corticosteroid	1 (0.2)		
Incorrect treatment	239 (57.2)		<0.001*
SABA+inhaled corticosteroid	179 (42.8)		
LABA +inhaled corticosteroid	60 (14.4)		
LTRA	—		
Question 8 (Discharge criteria at hospitalization)			
Correct response		296 (70.8)	
FEV ₁ > 70%			
Incorrect response		122 (29.2)	
Non-compliance to inhaled treatment		59 (14.1)	
SpO ₂ ≤ 91%		45 (10.8)	
Retraction		14 (3.3)	
Shortness of breath while talking		4 (1.0)	

SABA: short-acting β_2 agonist, LABA: long-acting β_2 agonist, FEV₁: forced expiratory volume in 1 s, LTRA: leukotriene receptor antagonist, SpO₂: saturation of oxygen, NA: not applicable.

[†]only for severe acute asthma.

[‡]only for moderate acute asthma.

**p* value was compared between questions 4 and 8.

initial treatment of the moderate acute asthma scenario preferred additional bronchodilator administration.

In the severe attack case scenario, 20.1% of the physicians used SABA in combination with either ipratropium bromide or magnesium sulfate, whereas 6.5% of physicians preferred ipratropium bromide as the single initial bronchodilator agent.

Treatment Plan After 1h (Questions 3 and 7)

Treatment choices of physicians for moderate and severe acute asthma after 1h are shown in Table 2. Seventy-five physicians (17.9%) accurately tailored treatment after 1h for both case scenarios. There was a significant difference between the moderate and severe attack case scenarios with respect to accurate planning of treatment after 1h ($p = .004$).

Fifty-five percent of the physicians undertreated the moderate attack case scenario. Anti-inflammatory treatment in the form of systemic corticosteroids and/or inhaled corticosteroids (ICS) was recommended by 89.2% of the physicians in the moderate attack case scenario. Ninety-nine percent of the physicians who chose systemic corticosteroids as anti-inflammatory treatment considered hospitalization. All the physicians who preferred ICS as the anti-inflammatory agent considered the ED as the treatment facility.

Oxygen, SABA, and hospitalization were recommended by all the physicians for treatment of the severe attack case scenario after 1h (Table 2). Two-hundred and seventy (64.6%) physicians added a leukotriene receptor antagonist (LTRA) and/or ICS to the treatment plan after 1h.

Discharge Recommendations/Criteria (Questions 4 and 8)

One-hundred and three physicians (24.6%) knew the discharge recommendations/criteria for both case scenarios. There was a significant difference in physicians' knowledge of discharge recommendations/criteria between moderate and severe acute asthma ($p < .001$). All but one physician prescribed bronchodilators, and 14.4% preferred inhaled long-acting β_2 -agonists (LABA). Ten percent of the physicians did not prescribe any kind of anti-inflammatory agent for treatment at home (Table 2).

DISCUSSION

Our data suggest that physicians performed well in terms of determining the severity and planning of the initial treatment for both moderate and severe asthma attacks. However, they showed poor performance in terms of planning treatment after the first hour and in discharge criteria. The physicians tended to undertreat moderate asthma attacks and overtreat severe asthma attacks after the first hour. In general, only 5% of the physicians responded to all the questions regarding moderate and severe attack case scenarios with an accurate treatment option.

Acute asthma management practices of physicians still do not track closely the recommendations in current

guidelines (4–12). Previous research documented a substantial gap between management practices of physicians and recommendations in guidelines (6, 13–15). When compared with previous research, our study included two case scenarios with sequential questions that assessed acute asthma management steps more thoroughly. Acute asthma is a dynamic condition with variable clinical presentations and treatment responses. This condition must be evaluated meticulously by physicians, and management steps should be tailored according to clinical progress and patients' response to treatment (1–3). The questions in our survey were closely related to the clinical progress of the patients and their response to treatment. This fact made possible more reliable evaluation of management practices of physicians. In accordance with this, when the questions were analyzed separately, the correct response rate was relatively high. However, the number of physicians who correctly answered all the four questions regarding management steps was notably low.

On the other hand, our study has several limitations. Questionnaire response rate (41.8% for fully completed questionnaires) is relatively low, that makes it somewhat difficult to generalize the results. Administering the questionnaire to participants at the annual meetings of general-pediatricians, intensivists and critical care physicians might influence our results. Furthermore, the questionnaire was administered to subjects who represent a small subpopulation of clinicians caring for children with asthma, which degrades external validity. In future studies, a better study design aiming a higher response rate should be implemented and a larger sample size with a more homogenous distribution of practitioners treating childhood asthma should be utilized.

All guidelines recommend SABAs as the first-line bronchodilator for the initial treatment regardless of the severity of the attack. Additional bronchodilators are recommended in the treatment plan after 1h for patients whose response to initial bronchodilator treatment is insufficient (1–3). Ipratropium bromide and intravenous magnesium sulfate are recommended as additional bronchodilators for treatment of childhood asthma; the effectiveness of these agents has been documented in several meta-analyses (16–19). In patients unresponsive to initial treatment, additional bronchodilators decrease hospitalization rates and improve respiratory function considerably (17–19). The bronchodilator use of the responding physicians was mostly in harmony with the guideline recommendations. Short-acting β_2 -agonists were preferred by almost all physicians for initial treatment, and more than 75% recommended additional bronchodilators in the treatment plan after 1h for patients unresponsive to the initial treatment. However, 20% of the physicians who opted to overtreat prematurely preferred additional bronchodilators in the initial treatment. Combined bronchodilator use in the early stages may not be cost-effective and may impose a considerable economic burden. In addition, 6.5% of physicians preferred ipratropium bromide as the only initial bronchodilator in the treatment of the severe acute asthma case scenario. Because it is less potent and its effect begins later compared with SABAs,

ipratropium bromide is not a sufficiently prompt or efficient treatment agent (16, 17).

Systemic corticosteroids are the most potent anti-inflammatory medications used in the treatment of asthma attacks (1–3). They decrease the risk of hospitalization and readmission rates associated with acute asthma (20). As a result, all guidelines recommend systemic corticosteroids at the initial treatment of a severe attack and in bronchodilator-unresponsive moderate attacks. ICS and LTRA are first-line anti-inflammatory drugs proven to be effective in chronic treatment of asthma (1–3). However, use of ICS in the treatment of acute asthma is controversial (21, 22). Evidence supporting the use of LTRA in the management of acute asthma is lacking (23). For this reason, LTRA use is not recommended in the guidelines for the treatment of acute asthma (1–3). In our study, for the treatment plan after 1h of the moderate attack case scenario, 20% of the physicians preferred ICS as the anti-inflammatory agent. However, for the treatment plan after 1h of the severe attack case scenario, two-thirds of physicians preferred ICS and/or LTRA. ICS and LTRAs are costly therapeutic agents; thus, widespread use of these drugs in the treatment of acute asthma may increase the economic burden of asthma.

In addition, the use of ICS instead of systemic corticosteroids may decrease the efficacy of treatment. All guidelines discourage the use of ICS instead of systemic corticosteroids and, to attain sustainable clinical improvement, recommend a short course (3–10 days) of systemic corticosteroid administration (1–3, 24, 25). However, research during the last 15 years indicates that physicians are conservative in systemic corticosteroid use and usually prefer inhaled rather than systemic corticosteroids (9–11, 25, 26). Because 20% of the physicians preferred inhaled rather than systemic corticosteroids in the moderate attack case scenario and more than 50% of the physicians recommended inhaled rather than systemic corticosteroids during discharge, our data confirm the ubiquity of the conservative approach. Research indicates that physicians' conservative approach to steroid use is influenced mainly by the steroid phobia of the population (26, 27).

According to our results, physicians' decision to treat in an inpatient or outpatient setting seems to be an important factor that influences a conservative approach. In the treatment plan after 1h in the moderate attack case scenario, all physicians who preferred ICS decided to treat their patients in an outpatient setting. In contrast, 99% of the physicians who preferred systemic corticosteroids decided to hospitalize their patients. In addition, almost half of the physicians who preferred systemic corticosteroids in the treatment plan after 1h switched to ICS treatment at the time of discharging their patients. For the severe attack case, 85% of physicians preferred systemic corticosteroids in the initial treatment, and all utilized these agents in the treatment plan after 1h. In addition, all physicians recommended hospitalization as a part of the management plan for this case. Most of the physicians started systemic corticosteroids in patients who were considered eligible for hospitalization; this approach is consistent with the

guideline recommendations (1–3). When treatment was planned to continue in an outpatient setting, ICS was the anti-inflammatory treatment of choice. Physicians decide between systemic or inhaled corticosteroids according to the setting in which drugs will be administered because life-threatening side effects of corticosteroids due to inadvertent application seem to be associated with the clinical setting.

Several reports have emphasized the numerous barriers related to divergence between guideline recommendations and physician practices. These barriers include the physician's attitude, personal experience, and knowledge (6, 13, 15, 28, 29). In our study, gender, experience, specialty, and working unit were not found to influence the management practices of physicians. Working at a hospital with a continuing training program was the only factor that influenced the accurate organization of the management plan of the severe attack case. In our country, reference hospitals carry out continuous medical education. Children with acute asthma and with a more severe clinical picture are frequently referred to these hospitals. As a result, physicians working at these hospitals have more experience in the management of severe cases. Educational activities held on a regular basis allow the physicians to update their knowledge and review evidence-based information.

In a study of the consistency between guideline recommendations and physician management practices in the treatment of acute asthma, it was shown that the preferences of physicians diverged significantly from the guidelines with increased disease severity (7). In another study, physician non-adherence was attributed to barriers to various components of asthma guidelines (13). Guideline recommendations are constructed in light of scientific, evidence-based information. However, the evidence level is not homogeneously high for each statement in the guidelines (30). Some parts of the acute asthma management recommendations of asthma guidelines include author opinions and statements with heterogeneous evidence levels, which render recommendations difficult to understand and adhere to. As a result, decision-making is hampered. There is a general consensus in the guidelines on the identification of attack severity and initial treatment issues (1–3). This was very well reflected in our results that physician practices and guideline recommendations were highly consistent in terms of evaluation of attack severity and organization of the initial treatment. However, obscure recommendations with varying evidence levels remain, especially with regard to the further treatment plans of patients unresponsive to initial treatment. Timing of systemic corticosteroid treatment in moderate asthma attack is an example of this situation. In GINA, systemic corticosteroid treatment in moderate asthma attack is recommended if response to initial SABAs therapy fails to achieve lasting improvement (no immediate response) and/or reassessment after 1 hour treatment is still suitable with moderate episode. In reality, both recommendations point to the importance of starting systemic corticosteroid treatment without any time delay if there is not sufficient response to initial bronchodilator treatment. However, this

may cause different interpretations among physicians. In this study, we accepted initializing systemic corticosteroid treatment according to the reassessment after initial treatment as “accurate treatment” and defined the use of systemic corticosteroid at the initial treatment as “overtreatment” for moderate acute asthma case which may be regarded as limitation because of imprecise expressions in asthma guidelines and different interpretations by the physicians. In conclusion, barriers impeding the translation of guideline recommendations to actual medical practice may be related to the obscure nature of some parts of the asthma guidelines.

CONCLUSIONS/KEY FINDINGS

Transmission of recommendations in regularly updated guidelines to the daily management practices of physicians remains far from optimal. This study documents the insufficiencies of the management practices of physicians by assessing all acute asthma management steps, particularly the insufficiencies in planning treatment after 1h in moderate and severe asthma attacks. The setting in which acute asthma management takes place likely influences physicians’ choice of anti-inflammatory drug. Postgraduate education programs that target physicians employed in hospitals without continuing medical education facilities and that are held on a regular basis may improve guideline adherence.

DECLARATION OF INTEREST

All authors contributed significantly to the work, and have approved and take full responsibility for the final manuscript. The authors have no conflicts of interest relevant to this study. There was no financial support for this study. The authors disclose no financial relationship with a biotechnology and/or pharmaceutical manufacturer that has an interest in the subject matter or materials discussed in the submitted manuscript.

REFERENCES

- Global strategy for asthma management and prevention. Revised 2010. Global Initiative for Asthma. Available at: <http://www.ginasthma.org>. Accessed August 3, 2012.
- National Institutes of Health NAEPP Expert Panel Report 3. Guidelines for the diagnosis and management of asthma national asthma education and prevention program. National Heart, Lung and Blood Institute. Available at: <http://www.nhlbi.nih.gov>. Accessed August 3, 2012.
- British Thoracic Society and Scottish Intercollegiate Guidelines Network. British guideline on the management of asthma. Available at: <http://www.sign.ac.uk/guidelines>. Accessed August 3, 2012.
- Stevens MW, Gorelick MH. Short-term outcomes after acute treatment of pediatric asthma. *Pediatrics* 2001; 107(6):1357–1362.
- Coffman JM, Cabana MD, Halpin HA, Yelin EH. Effects of asthma education on children’s use of acute care services: A meta-analysis. *Pediatrics* 2008; 121(3):575–586.
- Lougheed MD, Garvey N, Chapman KR, Cicutto L, Dales R, Day AG, Hopman WM, Lam M, Sears MR, Szpiro K, To T, Paterson NA. Variations and gaps in management of acute asthma in Ontario emergency departments. *Chest* 2009; 135(3):724–736.
- Babl FE, Sheriff N, Borland M, Acworth J, Neutze J, Krieser D, Ngo P, Schutz J, Thomson F, Cotterell E, Jamison S, Francis P. Paediatric acute asthma management in Australia and New Zealand: Practice patterns in the context of clinical practice guidelines. *Arch Dis Child* 2008; 93(4):307–312.
- Soyer OU, Civelek E, Sekerel BE. Physicians’ perception of childhood asthma in Turkey: More appropriate practice among female physicians. *BMC Health Serv Res* 2008; 23(8):155.
- Tan C, Wong B, Goh DY, Van Bever HP. Monitoring and treatment practices of childhood asthma in Singapore: A questionnaire study. *Singapore Med J* 2009; 50(1):54–61.
- Lee PL, Luo JP, Shieh WM, Nien CT, Yang PC, Kuo SH. Hospital-based management of acute asthmatic exacerbation: An assessment of physicians’ behavior in Taiwan. *J Asthma* 2001; 38(7):575–583.
- Grunfeld A, Beveridge RC, Berkowitz J, FitzGerald JM. Management of acute asthma in Canada: An assessment of emergency physician behaviour. *J Emerg Med* 1997; 15(4):547–556.
- Canonica GW, Baena-Cagnani CE, Blaiss MS, Dahl R, Kaliner MA, Valovirta EJ, GAPP Survey Working Group. Unmet needs in asthma: Global Asthma Physician and Patient (GAPP) Survey: Global adult findings. *Allergy* 2007; 62(6):668–674.
- Cabana MD, Rand CS, Becher OJ, Rubin HR. Reasons for pediatrician nonadherence to asthma guidelines. *Arch Pediatr Adolesc Med* 2001; 155(9):1057–1062.
- Moy JN, Grant EN, Turner-Roan K, Li T, Weiss KB. Asthma care practices, perceptions, and beliefs of Chicago-area asthma specialists. Chicago asthma surveillance initiative project team. *Chest* 1999; 116(4 Suppl 1):154S–162S.
- Bhagal S, Bourbeau J, McGillivray D, Benedetti A, Bartlett S, Ducharme F. Adherence to pediatric asthma guidelines in the emergency department: A survey of knowledge, attitudes and behaviour among health care professionals. *Can Respir J* 2010; 17(4):175–182.
- Teoh L, Cates CJ, Hurwitz M, Acworth JP, van Asperen P, Chang AB. Anticholinergic therapy for acute asthma in children. *Cochrane Database Syst Rev* 2012; 18(4):CD003797.
- Plotnick LH, Ducharme FM. Combined inhaled anticholinergics and beta2-agonists for initial treatment of acute asthma in children. *Cochrane Database Syst Rev* 2000; 4:CD000060.
- Mohammed S, Goodacre S. Intravenous and nebulised magnesium sulphate for acute asthma: Systematic review and meta-analysis. *Emerg Med J* 2007; 24(12):823–830.
- Cheuk DK, Chau TC, Lee SL. A meta-analysis on intravenous magnesium sulphate for treating acute asthma. *Arch Dis Child* 2005; 90(1):74–77.
- Rowe BH, Spooner C, Ducharme FM, Bretzlaff JA, Bota GW. Early emergency department treatment of acute asthma with systemic corticosteroids. *Cochrane Database Syst Rev* 2001; 1:CD002178.
- FitzGerald JM, Becker A, Sears MR, Mink S, Chung K, Lee J, Canadian Asthma Exacerbation Study Group. Doubling the dose of budesonide versus maintenance treatment in asthma exacerbations. *Thorax* 2004; 59(7):550–556.
- Harrison TW, Osborne J, Newton S, Tattersfield AE. Doubling the dose of inhaled corticosteroid to prevent asthma exacerbations: Randomised controlled trial. *Lancet* 2004; 363(9405):271–275.
- Watts K, Chavasse RJ. Leukotriene receptor antagonists in addition to usual care for acute asthma in adults and children. *Cochrane Database Syst Rev* 2012; 16(5):CD006100.
- Rowe BH, Spooner CH, Ducharme FM, Bretzlaff JA, Bota GW. Corticosteroids for preventing relapse following acute exacerbations of asthma. *Cochrane Database Syst Rev* 2007; 18(3):CD000195.
- Edmonds ML, Camargo CA Jr, Pollack CV Jr, Rowe BH. Early use of inhaled corticosteroids in the emergency department treatment of acute asthma. *Cochrane Database Syst Rev* 2003; 3:CD002308.
- Mackey D, Myles M, Spooner CH, Lari H, Tyler L, Blitz S, Senthilselvan A, Rowe BH. Changing the process of care and practice in acute asthma in the emergency department: Experience with an asthma care map in a regional hospital. *CJEM* 2007; 9(5):353–365.
- Civelek E, Sekerel BE. Management of childhood asthma: Physicians’ perspective in Turkey. *Pediatr Allergy Immunol* 2004; 15(4):372–375.

28. Lagerlöv P, Veninga CC, Muskova M, Hummers-Pradier E, Stålsby Lundborg C, Andrew M, Haaijer-Ruskamp FM. Asthma management in five European countries: Doctors' knowledge, attitudes and prescribing behaviour. Drug Education Project (DEP) group. Eur Respir J 2000; 15(1):25–29.
29. Finkelstein JA, Lozano P, Shulruff R, Inui TS, Soumerai SB, Ng M, Weiss KB. Self-reported physician practices for children with asthma: Are national guidelines followed? Pediatrics 2000; 106(4 Suppl): 886–896.
30. Bousquet J, Clark TJ, Hurd S, Khaltaev N, Lenfant C, O'byrne P, Sheffer A. GINA guidelines on asthma and beyond. Allergy 2007; 62(2): 102–112.

APPENDIX 1. QUESTIONNAIRE

Case Scenario 1

A four-year old female patient with a history of intermittent asthma was under clinical control for the past 6 months. She presented to the pediatric ED with a 2-day history of cough and wheezing. Vital signs were: T 36.8°C, RR 44/min, HR 120/min, and SpO₂ in room air 92%. She had end-expiratory wheezing on auscultation and intercostal retractions on her physical examination.

Question 1. How would you classify the severity of this patient's acute asthma?

- ☐ Mild acute asthma ☐ Moderate acute asthma
☐ Severe acute asthma ☐ Life-threatening acute asthma

Question 2. What medications would you order for this patient at initial treatment?

- ☐ 100% supplemental oxygen ☐ Short-acting β_2 agonist
☐ Inhaled ipratropium bromide ☐ Intravenous magnesium sulphate
☐ Inhaled corticosteroid ☐ Systemic corticosteroid

The patient was reassessed after 1h of initial treatment. Her repeat physical examination showed:

RR 46/min, HR 118/min, and SpO₂ 92%.

Her end-expiratory wheezing on auscultation and intercostal retractions continued.

Question 3. What would you order for the patient at this stage?

- ☐ Admit to emergency ward ☐ Hospitalization
☐ 100% supplemental oxygen ☐ Short-acting β_2 -agonist
☐ Inhaled ipratropium bromide ☐ Intravenous magnesium sulfate
☐ Inhaled corticosteroid ☐ LTRA
☐ Systemic corticosteroid

Question 4. When the patient was re-evaluated after 4h of initial treatment, you realized that her oxygen saturation had increased (SpO₂ > 95%) and her respiratory distress had disappeared. Which of the following treatment options should be implemented at this stage?

- ☐ Discharge home with a short-acting β_2 -agonist.

- ☐ Discharge home with a systemic corticosteroid.
☐ Discharge home with an inhaled corticosteroid.
☐ Discharge home with a short-acting β_2 -agonist plus an inhaled corticosteroid.
☐ Discharge home with a short-acting β_2 -agonist plus an LTRA.
☐ Discharge home with a short-acting β_2 -agonist plus a systemic corticosteroid.
☐ Discharge home with long-acting β_2 -agonist therapy plus an inhaled corticosteroid.
☐ Discharge home with long-acting β_2 -agonist therapy plus a systemic corticosteroid.

Case Scenario 2

An 8-year-old male patient with a history of moderate persistent asthma presented with dyspnea of 1-day duration. On his evaluation at the pediatric ED, he had dyspnea at rest, could hardly reply to questions in single words, and his PEF value was < 50% of the predicted value for the patient.

Question 5. How would you classify the severity of this patient's acute asthma?

- ☐ Mild acute asthma ☐ Moderate acute asthma
☐ Severe acute asthma ☐ Life-threatening acute asthma

Question 6. What medications would you order for this patient at initial treatment?

- ☐ 100% supplemental oxygen ☐ Short-acting β_2 -agonist
☐ Inhaled ipratropium bromide ☐ Intravenous magnesium sulfate
☐ Inhaled corticosteroid ☐ Systemic corticosteroid

Question 7. After the initial treatment in the ED, he was reassessed. His clinical signs and symptoms did not resolve. What is the most appropriate treatment option at this stage?

- ☐ Treatment should continue in the ED ☐ Hospitalization
☐ 100% supplemental oxygen ☐ Short-acting β_2 -agonist
☐ Inhaled ipratropium bromide ☐ Intravenous magnesium sulfate
☐ Inhaled corticosteroid ☐ LTRA
☐ Systemic corticosteroid

Question 8. If this patient was hospitalized, which of the following would not be a contraindication for discharge?

- ☐ FEV₁ > 70% ☐ Retractions on physical examination
☐ SpO₂ < 91% ☐ Dyspnea on speech
☐ Non-compliance to inhaled treatment

Notes: ED, emergency department; HR, heart rate; RR, respiratory rate; SpO₂, saturation of oxygen; PEF, peak expiratory flow; FEV₁, forced expiratory volume in 1s; LTRA, leukotriene receptor antagonist.