



Korean Asthma Guideline 2014: Summary of Major Updates to the Korean Asthma Guideline 2014

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Asthma is a prevalent and serious health problem in Korea. Recently, the Korean Asthma Guideline has been updated by The Korean Academy of Tuberculosis and Respiratory Diseases (KATRD) in an effort to improve the clinical management of asthma. This guideline focuses on adult patients with asthma and aims to deliver up to date scientific evidence and recommendations to general physicians for the management of asthma. For this purpose, this guideline was updated following systematic review and meta-analysis of recent studies and adapting some points of international guidelines (Global Initiative for Asthma [GINA] report 2014, National Asthma Education and Prevention Program [NAEPP] 2007, British Thoracic Society [BTS/SIGN] asthma guideline 2012, and Canadian asthma guideline 2012). Updated issues include recommendations derived using the population, intervention, comparison, and outcomes (PICO) model, which produced 20 clinical questions on the management of asthma. It also covers a new definition of asthma, the importance of confirming various airflow limitations with spirometry, the epidemiology and the diagnostic flow of asthma in Korea, the importance and evidence for inhaled corticosteroids (ICS) and ICS/formoterol as a single maintenance and acute therapy in the stepwise management of asthma, assessment of severity of asthma and management of exacerbation, and an action plan to cope with exacerbation. This guideline includes clinical assessments, and treatment of asthma–chronic obstructive pulmonary disease overlap syndrome, management of asthma in specific conditions including severe asthma, elderly asthma, cough variant asthma, exercise-induced bronchial contraction, etc. The revised Korean Asthma Guideline is expected to be a useful resource in the management of asthma.

Keywords: Asthma; Koreans; Guideline

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Received: Dec. 1, 2015, **Revised:** Dec. 20, 2015, **Accepted:** Dec. 21, 2015

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Background

Asthma is an inflammatory airway disease that affects about 30 billion people worldwide¹. The prevalence of asthma in Korea in adults was studied in 1998 by The Korean Academy of Tuberculosis and Respiratory Diseases (KATRD); that study revealed that 12.8% of 8,823 adults had some form of asthma². Despite the high prevalence and clinical importance of asthma, the Korean Asthma Guideline had not been updated since November 2005³ while the Korean Asthma Guideline was first published in 2000.

Recently, several of important results on the epidemiology, pathophysiology, treatment, and management of asthma have been reported. Therefore, it was necessary to revise the Korean guideline based on updated knowledge and share the guideline with all physicians who manage patients with asthma. This review aims to summarize the major changes to the updated Korean Asthma Guideline for adults.

Introduction to the Korean Asthma Guideline 2014

The Korean Asthma Guideline 2014 is targeted to all doctors who manage patients with asthma in daily practice⁴. The Korean guideline emphasizes that asthma is characterized by respiratory symptoms such as wheezing, shortness of breath, tightness in the chest, and coughing, accompanied by variable expiratory airflow limitation. Based on the characteristics of asthma, the guideline focuses on the importance of identifying reversible or variable airflow limitation using spirometry. The Korean guideline addresses 20 key questions selected using the population, intervention, comparison, and outcomes (PICO) method that aid in the treatment of asthma and presents evidence-based recommendations made after intensive systematic review and meta-analysis of recently updated PICO reports. It also adapts some points of international guidelines (Global Initiative for Asthma [GINA] report 2014⁵, National Asthma Education and Prevention Program [NAEPP] 2007⁶, British Thoracic Society [BTS/SIGN] 2012⁷, Canadian Asthma Guideline 2012⁸).

The updated Korean Asthma Guideline covers the new definition of asthma, the epidemiology of asthma in Korea, the diagnostic flow of asthma, treatment recommendations based on updated evidence including the importance of and evidence for inhaled corticosteroids (ICS) and ICS/formoterol as single maintenance and reliever therapy in the stepwise management of asthma, the concept, diagnosis, and treatment of asthma-chronic obstructive pulmonary disease overlap syndrome, assessment of severity and management of asthma exacerbation, and an action plan to cope with asthma exacerbation. The Korean guideline also covers the symptoms of asthma in specific conditions including severe asthma, asth-

ma in elderly people, cough variant asthma, exercise-induced bronchial constriction, occupational asthma, management in a perioperative period or pregnancy, and comorbidities.

An appendix contains discussion on practical methods for the diagnosis of asthma such as spirometry, peak flow meter, and bronchial provocation tests. Inhaled medications and devices available in Korea for treating asthma are also discussed. Finally, indications for the use of various medications issued by the National Health Insurance Service are described.

Methods

A steering committee and a scientific committee for the Korean Asthma Guideline were composed of 50 pulmonologists from different areas of the country. The guideline was developed by de novo process as well as adaptation of international asthma guidelines, and was peer reviewed. Specialists in systematic review and meta-analysis were also involved during the entire period of guideline development. After searching three databases (The National Guideline Clearinghouse, <http://www.guideline.gov/>; the Guideline International Network, <http://www.g-i-n.net/library/international-guidelines-library>; and the Trip database, <https://www.tripdatabase.com>), guidelines satisfying the following criteria were selected for adaptation: (1) guidelines developed in a country similar to Korea in terms of climate and region; (2) international guidelines or guidelines developed by international groups; (3) guidelines developed or updated since 2011; (4) guidelines for adults; and (5) guidelines containing general information on the diagnosis, treatment, and management of asthma.

Finally, four guidelines from GINA, NAEPP, SIGN, and Canada were selected after using the AGREE II method (<http://www.agreetrust.org/agree-ii/>)⁹. A scientific committee developed key questions related to the management of asthma.

If the key questions agreed with the selected guidelines with a very high quality of evidence, the Korean guideline includes them. If the key questions did not appear in the selected guidelines or were out of date, new recommendations were developed using PICO after systematic review. Systematic review involved searching databases including Medline (<http://www.ncbi.nlm.nih.gov/pubmed>), EMBASE (<https://www.embase.com>), and the Cochrane library (<http://www.cochranelibrary.com/>). The analysis included only data gathered from randomized controlled studies and systematic reviews.

Evidence and strength of recommendation for each key question was determined with the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) method^{10,11}. The quality of evidence was classified as 'high,' 'moderate,' 'low,' 'very low,' or 'expert opinion.' The strength of each recommendation was classified as 'strong' or 'weak.'

The Korean Asthma Guideline was circulated and approved for publication by the following organizations, which may

have conflicts of interest: the Korean Asthma and Allergy Society, the Korean Medical Association, the Korean Physicians' Association, the Korean Academy of Family Medicine, the Korean General Physician Association, the Korean Association of Internal Medicine, the Korean Nurse Association, the Health Insurance Review and Assessment Service, the National Health Insurance Service, the Ministry of Health and Welfare, and the Korean Centers for Disease Control and Prevention.

Twenty key questions developed using PICO were issued following systematic review and finalizing of recommendations. They are as follows:

- 1) Are ICS the best pharmacologic agent for maintenance of asthma in adults?
- 2) In step 3 of stepwise approaches to asthma control, is an inhaled long acting beta-2 agonist (LABA) the optimal first choice as an add-on therapy in patients with asthma that is not well controlled with low doses of ICS?
- 3) In step 3 of stepwise approaches to asthma control, is it effective to add leukotriene receptor antagonists (LTRA) to the treatment regimen of asthma patients whose disease is not well controlled with low doses of ICS?
- 4) In step 3 of stepwise approaches to asthma control, is it effective to increase the medium recommended dose of ICS for asthma patients whose disease is not well controlled with low doses of ICS?
- 5) Is combination therapy with LABA more effective than LTRA add-on therapy in asthma patients whose disease is not well controlled with low doses of ICS?
- 6) Can budesonide/formoterol combination therapy be used as a rescue therapy as well as a maintenance therapy? Does it decrease the frequency of acute asthma attacks and improve asthma symptoms at relatively low doses?
- 7) In step 5 of stepwise approaches to asthma control, is oral corticosteroid effective in combination with other controller medications?
- 8) Is LTRA more effective than ICS for controlling asthma in elderly patients with asthma?
- 9) Is it effective to add tiotropium to the treatment regimen of patients whose disease is not well controlled with ICS/LABA?
- 10) Is bronchial thermoplasty effective in patients with severe asthma?
- 11) Is the prophylactic use of macrolide effective in controlling asthma and preventing acute exacerbation of asthma?
- 12) Do systemic steroids decrease the mortality, recurrence, hospital admission rate, and use of rescue medications in patients with acute exacerbation?
- 13) Is it more effective to administer both short-acting beta-2 agonists (SABA) and ipratropium bromide through a nebulizer than it is to administer SABA alone in cases of

acute exacerbation?

- 14) Is there any difference in efficacy between treating asthma with pressurized metered dose inhaler (pMDI)+ spacer versus a nebulizer in patients with mild to moderate exacerbation of asthma?
- 15) Does intravenous aminophylline have any additional benefit in controlling acute exacerbation of bronchial asthma when it is added to the standard treatment of inhaled bronchodilators and steroids?
- 16) Is nebulized magnesium therapy effective in controlling acute exacerbation of bronchial asthma?
- 17) Is non-invasive positive pressure ventilation (NPPV) therapy effective in the treatment of acute respiratory distress following severe exacerbation of bronchial asthma?
- 18) Does subcutaneous immunotherapy have any clinical benefit compared with a placebo in controlling allergic bronchial asthma?
- 19) Is inhaled SABA effective in the treatment of exercise-induced bronchoconstriction when it is used just before exercise?
- 20) Is ICS effective and safe to use in pregnant patients with asthma?

Summary of Major Updates to the Korean Asthma Guideline

1. Definition of asthma

"Asthma is a heterogeneous disease characterized by chronic airway inflammation. Symptoms include wheezing, shortness of breath, chest tightness, and cough which are variable over time and in intensity and accompanied by variable expiratory airflow limitation." This definition stresses the typical respiratory symptoms and associated variable airflow limitation measured objectively.

2. Prevalence, mortality, and burden of asthma

Asthma is a very common disease worldwide and its prevalence is increasing. The prevalence of asthma in Korea has been increasing, especially in children and elderly people. The prevalence of asthma varies in different studies because of differences in measurement methods. The prevalence of asthma in Korea was 12.8% in 1998 as reported by KATRD following a nation-wide survey given to 8,823 adults that asked about the presence of wheeze in the previous 12 months². When the criteria were restricted to the cases satisfying the questionnaire and provocation test, the prevalence was 3.4%. In the GINA report (2004), the reported prevalence of asthma in Korea was 3.9%, which was lower than the prevalence in the United States (10.9%) or Japan (6.7%)¹².

According to the Korean National Health and Nutrition Examination Survey (KNHANES), the prevalence of physician-diagnosed asthma increased to 2.0% in 2008 from 0.7% in 1998¹³.

As assessed from Korean national insurance data, the prevalence of asthma was 4.7% in 2008; asthma was defined as the presence of an asthma code and history of treatment. Occupational asthma is reported to account for up to 10% of total cases of asthma¹⁴.

The mortality rate associated with asthma and an accurate estimate of the total number of asthma cases has not been reported in Korea. Mortality caused by chronic lower respiratory diseases including asthma decreased from 22.6 cases per 100,000 people in 2002 to 15.6 cases per 100,000 people in 2012. However, as most of the mortality occurred in elderly people (those over 60 years of age), mortality of asthma is expected to be much lower in the younger population¹⁵.

In a report based on Korean insurance claim data, the total cost of asthma-related health care was about 742,000,000 dol-

lars, which was used to treat 2,270,000 patients with asthma in 2008¹⁴. The direct cost was 64.5%, while the indirect cost was 35.5%. Medical cost per person increased with age.

3. Diagnosis, assessment, and differential diagnosis of asthma

Asthma can be diagnosed by identifying the typical characteristics of respiratory symptoms and variable airflow limitation, as shown in Table 1. Details reflecting variable expiratory airflow limitation are included in the guideline; it adopted the recently updated GINA guidelines. Briefly, variable expiratory flow limitation can be measured with a bronchodilator reversibility test, variability in peak expiratory flow (PEF), significant changes in lung function after 4 weeks of anti-inflammatory treatment, and bronchial provocation tests.

Initial diagnostic flow shown in Figure 1 is based on the diagnostic criteria given in Table 1. However, it includes clinical settings in which spirometry/PEF meters and reversibility

Table 1. Diagnosis of asthma based on clinical characteristics and variable airflow limitation

Diagnostic feature	Criteria for making diagnosis of asthma
History of variable respiratory symptoms	
Wheezing, shortness of breath, chest tightness, and coughing	Generally more than one type of respiratory symptom (in adults, isolated cough is seldom due to asthma) Symptoms vary over time and in intensity Symptoms are often worse at night or upon awakening Symptoms are often triggered by exercise, laughter, allergens, or cold air Symptoms often appear or worsen with viral infections
Confirmed variable expiratory airflow limitation	
Documented excessive variability in lung function (one or more of the tests below) and documented airflow limitation	As the greater the variations, or the more occasions excess variation is seen, the diagnosis of asthma is more confident. At least once during the diagnostic process when FEV ₁ is low, confirm that FEV ₁ /FVC is reduced (normal levels are >0.75–0.80 in adults)
Positive BD reversibility test (more likely to be positive if BD medication is withheld before test: SABA ≥4 hours, LABA ≥15 hours)	Increase in FEV ₁ of >12% and >200 mL from baseline, 10–15 minutes after 200–400 µg albuterol or equivalent (greater confidence if increase is >15% and >400 mL)
Excessive variability in twice-daily PEF over 2 weeks	Average daily diurnal PEF variability >10%
Significant increase in lung function after 4 weeks of anti-inflammatory treatment	Increase in FEV ₁ of >12% and >200 mL (or increase in PEF of >20%) from baseline after 4 weeks of treatment, in the absence of respiratory infections
Positive exercise challenge test*	Fall in FEV ₁ of 10% and >200 mL from baseline
Positive bronchial challenge test	Decrease in FEV ₁ from baseline of ≥20% with standard doses of methacholine or histamine, or ≥15% with standardized hyperventilation, hypertonic saline or mannitol challenge
Excessive variation in lung function between visits (less reliable)	Variation in FEV ₁ of >12% and >200 mL between visits, in the absence of respiratory infections

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It is defined by a history of respiratory symptoms such as wheezing, shortness of breath, chest tightness, and coughing that vary over time and in intensity, together with variable expiratory airflow limitation.

FEV₁: forced expiratory volume in 1 second; FVC: forced vital capacity; BD: bronchodilator; SABA: short-acting beta-2 agonists; LABA: long acting beta-2 agonist; PEF: peak expiratory flow.

tests are not available and clinical diagnosis via therapeutic trials with ICS and SABA is needed. In such cases, the guideline recommends that diagnostic tests should be performed within 1–3 months.

When physicians meet with their patients, they should assess the extent of asthma symptom control over the last 4 weeks. ‘Controlled’ is defined when patients answered “no” to all the questions below; ‘partly controlled’ is defined when patients answered “no” to one or two of the questions, and ‘uncontrolled’ means that patients answered “yes” to three or four of questions.

- 1) Daytime asthma symptoms more than twice per week?
- 2) Night waking due to asthma?
- 3) Rescue inhaler needed for treatment of acute symptoms more than twice per week?
- 4) Any activity limitation due to asthma?

Tools including the asthma control test (ACT; <http://www.asthmacontrol.com>) and the asthma control questionnaire (ACQ) can be useful in distinguishing between different levels of symptom control. ACT score ranges from 5 to 25. Scores of 20–25 indicate well-controlled asthma, while scores of 5–15 indicate very poorly controlled asthma.

Besides assessment of control status, the guideline emphasizes the importance of assessing inhaler techniques, adherence to treatment, adverse events, comorbidity, and future risk. A recent history of exacerbation, poor adherence to drug regimens, inadequate inhaler techniques, poor spirometric data, smoking, eosinophilia, fixed airflow limitation, and ad-

verse events all increase the future risk of asthma attacks.

As the most useful diagnostic parameter for anticipating future risk in patients with asthma is lung function, tests for lung function are mandatory 3–6 months after the beginning of treatment and periodically thereafter, as well as at the time of initial diagnosis. A discordance between symptoms and lung function may indicate a need for further tests.

4. Treatment and prevention

This guideline updated the recommendations for medical treatment and prevention of asthma based on updated evidence in order to improve the management of asthma, minimize the future risk of exacerbations, reduce fixed airflow limitation, and reduce the adverse effects of treatment.

Medications for control of asthma can be subdivided into ‘controller’ and ‘reliever’ types. A controller should be used consistently over the long term to attenuate airway inflammation, while a reliever should be used as needed to relieve acute symptoms via rapid bronchodilation. Controllers include ICS, the combination of ICS and a LABA, anti-leukotriene agents, systemic steroids, and anti-IgE antibody.

Because inhaled medications directly deliver drugs to affected airways in high concentrations while minimizing systemic effects, inhaled medication is the first choice of treatment for asthma.

Until now, ICS has been the most effective controller medication with anti-inflammatory action¹⁶⁻¹⁹. Therefore, ICS is

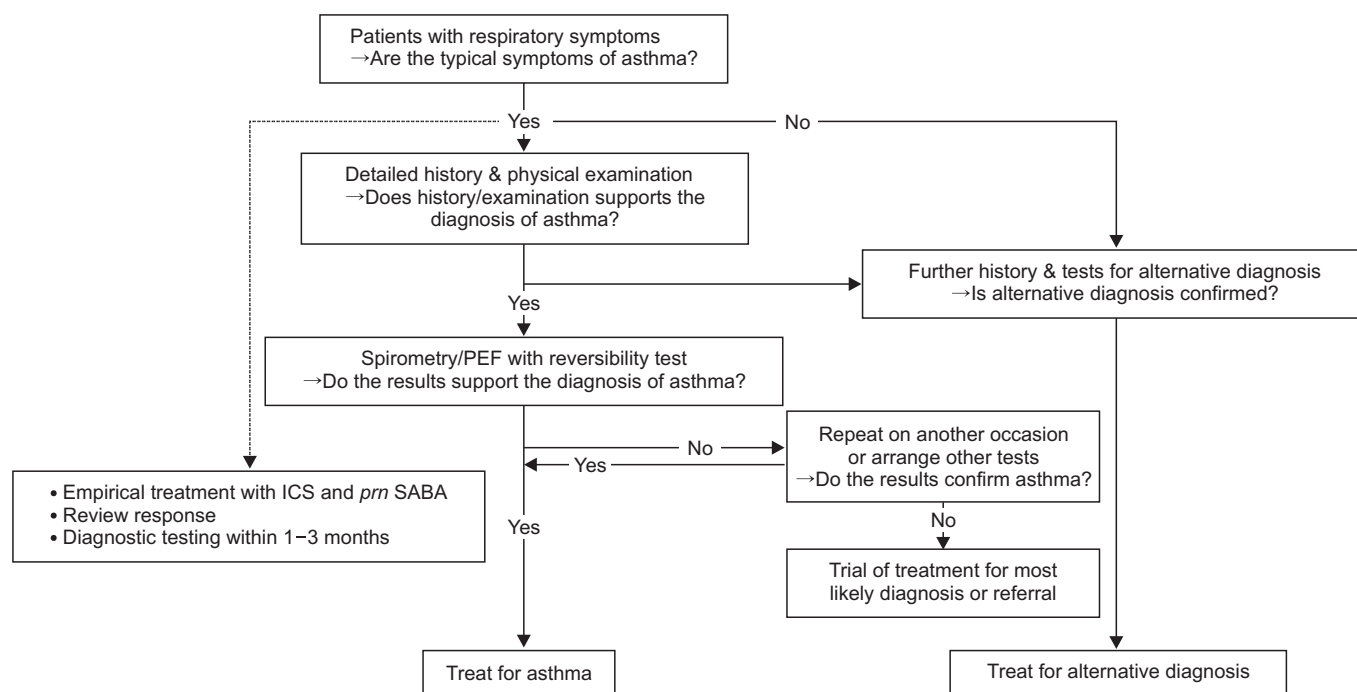


Figure 1. Initial diagnostic flow to be used in clinical practice. PEF: peak expiratory flow; ICS: inhaled corticosteroids; *prn*: as needed; SABA: short acting beta-2 agonist.

recommended for all patients with asthma if it is available and the patient does not experience adverse effects (evidence, high; recommendation, strong). The Korean guideline describes the clinical effects of new therapeutic agents including anti-interleukin (IL)-5 and anti-IL-13. Based on positive clinical results of use of tiotropium, it should be considered as an additional medication in cases where asthma is not controlled with ICS/LABA (evidence, high; recommendation, strong).

This guideline adopted a cyclic approach consisting of assessment, adjustment, and review of response⁵. After assessing control status, a stepwise approach is recommended to achieve 'controlled asthma' (Table 2). The role of ICS as a preferred controller is emphasized and it should be used in all steps. Even in step 1, ICS should be considered as an alternative controller option. Depending on the status of disease control, ICS/LABA is used in steps 3 and above²⁰. LABA is preferentially recommended for patients whose disease is not well controlled with low doses of ICS (evidence, high; recommendation, strong). One of the focus points in the guideline is that low doses of an ICS/formoterol combination can be used as an as-needed reliever in addition to inhaled short acting beta agonists (evidence, high; recommendation, strong)²¹.

Prior to stepping up asthma treatment, physicians should always assess the level of asthma control, adherence to treatment, and inhaler techniques. Once treatment is stepped up, treatment response should be assessed for at least 2–3 months. If asthma is well controlled for 3 months, stepping down treatment can be considered. In stepping down, usually the dosage of ICS is decreased by 25%–50%. If low dose ICS/LABA is maintained, the frequency of ICS/LABA use can be decreased to once daily. When stepping down treatment, instructions and asthma action plans should be provided to the patients.

If the patients suffer from frequent exacerbation despite maximal and optimal medical treatment, efforts to identify and treat modifiable risk factors can reduce the risk of exacerbation.

5. Management of acute exacerbation

Exacerbation of asthma, or 'flare-up,' is defined as acute or sub-acute worsening of symptoms and lung function compared to the patient's normal status and requires a change in treatment²².

The first step in managing acute exacerbation is to assess the severity of exacerbation with a brief focused history and physical examination, accompanied by promptly initiation of treatment. If the patient talks in words rather than full sentences, sits hunched forwards, is agitated, breathes rapidly (>30/min), and/or uses accessory muscles for breathing, severe exacerbation is present. Tachycardia (>120/min), desaturation (<90%), or decreased PEF (≤50% of predicted or best) are also sign of a severe flare-up and SABA, oxygen therapy, and/or systemic steroids should be administered.

Mild exacerbation may be managed in primary care centers and patients may be given a written action plan to prevent future flare-ups. However, written action plans should be given only if the patient can understand and comply with them. In moderate exacerbation, inhaled SABA is effective when it is administered every 20 minutes for one hour. Afterwards, the dose and interval of SABA may be altered depending on the severity of exacerbation. As systemic steroids are effective in decreasing mortality, recurrence, hospitalization, and use of relievers, early administration of systemic steroids (prednisolone 1 mg/kg, maximum 50 mg/24 hours) is recommended when exacerbation occurs^{23,24}. Oxygen is usually administered to achieve arterial oxygen saturation of 93%–95%.

Prior to discharge after exacerbation, arrangements for medications including 5–7 days of systemic steroids, education on inhaler techniques, and a written asthma action plan should be made.

6. Asthma in specific conditions

The Korean guideline covers the management of asthma in specific conditions including severe asthma, asthma in elderly patients, cough variant asthma, exercise-induced bronchoconstriction, occupational asthma, and management of

Table 2. Stepwise approach to control asthma

Step	Preferred controller	Other controller options	Reliever
Step 1	-	Low dose ICS	As-needed SABA
Step 2	Low dose ICS	LTRA Low dose theophylline	
Step 3	Low dose ICS/LABA	Medium/high dose ICS Low dose ICS+LTRA (or +theophylline)	As-needed SABA or low dose ICS/formoterol
Step 4	Medium/high ICS/LABA	High dose ICS+LTRA (or +theophylline)	
Step 5	Refer for add-on treatment	Add low dose oral corticosteroids	

ICS: inhaled corticosteroids; SABA: short-acting beta2 agonist; LTRA: leukotriene antagonist; LABA: long acting beta-2 agonist.

asthma in perioperative periods, pregnancy, and the presence of comorbid diseases. The key points are as follows.

First, in cases of severe asthma that is not controlled with high-dose ICS and one or more other controllers, add-on treatment options may be considered.

Add-on therapy with tiotropium is recommended for patients with severe asthma that is not controlled by an ICS/LABA combination (evidence, high; recommendation, strong)²⁵⁻²⁷. Leukotriene receptor antagonists can be also be considered as an add-on therapy in cases of severe asthma that is not well controlled with ICS/LABA²⁸. High doses of ICS and systemic corticosteroids may be considered to control severe asthma that is not responsive to lower doses of corticosteroids. However, systemic steroids should be maintained at the lowest possible dose.

Anti-IgE therapy for allergic severe asthma may be considered in order to reduce exacerbation and steroid dose and improve quality of life^{29,30}.

Bronchial thermoplasty may be a treatment option for improving quality of life and reducing the frequency of exacerbation in symptomatic patients with moderate to severe asthma that does not respond to maximal medication doses^{31,32}.

Although prophylactic macrolides therapy has been reported to reduce the frequency of exacerbation in non-eosinophilic severe asthma^{33,34}, it is generally not recommended as a maintenance therapy to control asthma and prevent exacerbation.

As asthma may be neglected or may overlap with other conditions in elderly people, careful attention should be paid when diagnosing asthma in elderly patients. The general principles for diagnosis and management are applicable to this population.

Cough variant asthma is a subtype of asthma that includes bronchial hyper-responsiveness as a typical feature. ICS is the mainstay in treating cough variant asthma.

In patients with exercise-induced bronchoconstriction, inhaled SABA is recommended prior to exercise as needed if the patient's symptoms occur during or after exercise and there is no other risk factor for exacerbation³⁵.

In all patients with adult-onset asthma, an occupational history should be taken. The identification and removal of occupational sensitizers is necessary in patients with occupational asthma.

Aspirin-exacerbated respiratory disease involves nasal congestion, anosmia, chronic rhinosinusitis with nasal polyps, and hypersensitivity to aspirin or nonsteroidal anti-inflammatory drugs. ICS is the mainstay of treatment and desensitization to aspirin can significantly improve quality of life, reduce symptoms, and decrease formation of nasal polyps and the need for oral corticosteroids.

In perioperative asthma patients, meticulous attention is necessary to track the status of asthma control and reduce perioperative complications. All patients should be maintained on regular controller therapy in perioperative periods

and additional preventative therapy may reduce asthma-related operative complications.

During pregnancy, one-third of pregnant women with asthma find that their asthma worsens, particularly in the second trimester³⁶, and the advantages of managing asthma properly outweighs any potential risks of inhaled medications. Regular ICS use is recommended in women with asthma during pregnancy (evidence, high; recommendation, strong).

Weight reduction may help to control asthma in patients with comorbid obesity. Therefore, weight reduction should be included in the treatment plan along with ICS in obese patients with asthma.

Rhinitis may be preceded or accompanied by asthma and is a risk factor for asthma. Appropriate management of rhinitis can reduce the symptoms of asthma.

7. Education and asthma action plan

It is important to establish an interactive physician-patient relationship, discuss objectives of asthma treatment, and provide individualized education for self-management. This guideline recommends providing patients with individualized written proper asthma action plans upon initial diagnosis and at the time of discharge from the clinical ward or emergency room.

Summary on Key Recommendations Arrived at through Systematic Review

- 1) ICS are the most effective drugs for general control of asthma and their use is recommended for all patients with asthma (evidence, high; recommendation, strong).
- 2) In step 3 of the stepwise approach to asthma control, inhaled LABA should be added to the treatment regimens of patients whose disease is not well controlled with low doses of ICS (evidence, high; recommendation, strong).
- 3) In step 3 of the stepwise approach to asthma control, LTRA is recommended as an add-on therapy in patients whose disease is not well controlled with low doses of ICS (evidence, high; recommendation, strong).
- 4) In step 3 of the stepwise approach to asthma control, it is recommended that the dose of ICS is increased to medium levels in patients whose disease is not well controlled with low doses of ICS (evidence, high; recommendation, strong).
- 5) In cases of asthma that is not controlled with ICS alone, combination therapy with LABA is more effective than add on therapy with LTRA (evidence, high; recommendation, strong).
- 6) Combination drugs with formoterol and budesonide can be used as controllers and relievers because they

reduce the risk of exacerbation and relieve symptoms of asthma (evidence, high; recommendation, strong).

- 7) In step 5 of the stepwise approach to asthma control, it is recommended that the minimum possible dose of oral corticosteroids is used (evidence, high; recommendation, strong).
- 8) In elderly asthma patients (those over 65 years of age), LTRA can be considered instead of ICS (evidence, low; recommendation, weak).
- 9) Tiotropium is recommended as an add-on therapy for asthma patients whose disease is not well controlled with a combination of ICS and LABA (evidence, high; recommendation, strong).
- 10) Bronchial thermoplasty is a viable treatment option for patients with moderate to severe asthma (evidence, low; recommendation, weak).
- 11) Macrolide is not recommended as a maintenance therapy in patients with severe asthma (evidence, high; recommendation, weak).
- 12) Systemic corticosteroids should be administered as early as possible to asthma patients with exacerbation because they can reduce the mortality, recurrence, admission, and use of relievers (evidence, high; recommendation, strong).
- 13) In patients with exacerbation who visit the emergency room, combined inhalation therapy with SABA and ipratropium bromide using a nebulizer is recommended because this technique produces a greater degree of bronchodilation and a shorter duration of recovery (evidence, high; recommendation, strong).
- 14) In patients with exacerbation, the bronchodilatory effect of SABA given by pMDI with spacers or nebulizers is similar (evidence, high; recommendation, strong).
- 15) Addition of intravenous aminophylline is not recommended for asthma patients with exacerbation (evidence, high; recommendation, strong).
- 16) Nebulized magnesium should not be given to asthma patients with exacerbation (evidence, low; recommendation, strong).
- 17) Because the efficacy of NPPV for treatment of respiratory failure due to severe exacerbation of asthma has not been established, it should be considered with caution in treating exacerbation of asthma (evidence, low; recommendation, weak).
- 18) Subcutaneous allergen-specific immunotherapy can be used when a specific allergen causing clinical symptoms is identified in patients with difficult-to-treat asthma despite maximal medical treatment (evidence, high; recommendation, strong).
- 19) Inhaled SABA should be administered before exercise in patients with exercise-induced bronchoconstriction (evidence, high; recommendation, strong).
- 20) ICS should be used regularly in women with asthma

during pregnancy (evidence, high; recommendation, strong).

Conclusion

The Korean Asthma Guideline has recently been revised to provide updated evidence-based treatment strategies to physicians who manage asthma. This guideline is targeted to improving the quality of asthma treatment and maximizing treatment efficacy; it is expected that the guideline will help minimize mortality and burden of this disease. Actively implementing this guideline in the Korean healthcare system will help achieve the ultimate goals of managing asthma.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

Acknowledgments

The Steering Committee of Asthma Study Group in KATRD

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