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MANAGEMENT OF ASTHMA IN PRIMARY HEALTHCARE

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ABSTRACT

Chronic asthma is chiefly characterized by occurrences of wheeze, coughing, and dyspnea induced by airway inflammation and hyperreactivity. It is among the most widespread chronic respiratory diseases in the United States, impacting 20 million individuals, which constitutes 8% of the adult demographic.[1,2]

Consequently, primary care clinics frequently encounter instances of asthma. The majority of individuals with asthma are expected to achieve effective management, and primary care physicians typically handle asthma quite proficiently. This article encapsulates the epidemiology, diagnosis, and both chronic and acute management of asthma from a primary care viewpoint.

KEYWORDS: Asthma; Review; Outpatient; Ambulatory; Treatment; Diagnosis

EPIDEMIOLOGY

Asthma prevalence is much higher among women (10.4%) compared to men (6.2%), individuals living in poverty (11.8%), and those identifying as racial or ethnic minorities, especially within the black community (10.2%) and Puerto Rican Hispanic heritage (14.9%). The geographic prevalence exhibits significant variation, fluctuating between 4.9% and 12.7% across different states. Almost fifty percent of adults suffering with asthma indicate experiencing one or more episodes in the past year, highlighting the importance of managing symptoms and controlling the disease despite numerous treatment options.[3].

Historically, asthma has been perceived as an ailment that mostly impacts the youth. Asthma is commonly diagnosed in youngsters, however it can manifest clinically at any age. Asthma is projected to impact 7 percent of individuals aged 65 and older, a figure that aligns with the general prevalence. A nationwide survey indicates that the annual incidence of initial diagnoses for individuals over 65 (3.1 percent) is not markedly different from that of those aged 18 to 34 (4.0 percent). Adult-onset asthma may be triggered by a background of prematurity, early respiratory infections, rhinitis, tobacco use, and obesity. The onset of a persistent cough in an elderly patient should not dissuade a physician from contemplating asthma.

DIAGNOSIS

Pulmonary function assessments and self-reported symptoms must be integrated for an accurate diagnosis of asthma. The eradication of ailments that resemble asthma is vital, particularly in the elderly who may be more susceptible to concurrent disorders, as asthma

symptoms can sometimes be indistinct and provoked by other pathological processes. A suggested diagnostic framework for asthma is provided (Fig. 1).

HISTORY

Wheezing, chest constriction, and coughing are common indicators of asthma. These manifestations may differ in intensity and often occur in episodes. Alterations in exposures, including allergens, airway irritants, or respiratory ailments, often align with fluctuations in symptoms. Exercise-induced bronchoconstriction is a prevalent adverse impact in some individuals, potentially aggravating asthma symptoms. Individuals with uncontrolled ailments may have persistent symptoms even during periods of inactivity. Individuals with asthma sometimes suffer from simultaneous rhinitis and sinusitis, while allergic rhinitis poses a risk for developing asthma; upper airway symptoms, thought to represent distinct expressions of a shared allergic pathophysiology, should be investigated. Chest constriction is seldom the sole symptom and should arouse concern for cardiovascular conditions. Providers must ascertain if the patient has any exposures that exacerbate their respiratory issues. Certain stimuli increase the probability that asthma is a contributing factor. Ten allergens are recognized as common provocateurs and may be either seasonal (often outdoor) or perennial (commonly indoor). The timing and dissemination of outdoor allergen exposure differ significantly throughout the United States. Pollen from outside sources such as weeds, grasses, and trees, which varies throughout the year, constitutes the primary factor in most outdoor allergies. Dust mites, rodents, cockroaches, mold spores, and animal dander are several instances of chronic allergens. Cigarette consumption, exposure to passive smoke, allergens, fragrances or potent odors, severe temperatures, physical activity, or psychological stress are some other non-allergic factors. Occupational exposures may lead to the onset of asthma (work-induced asthma) or exacerbate existing conditions (work-exacerbated asthma)[11,12]. Inquiring about occupational exposures is essential for diagnosing asthma and assessing variations in symptom intensity (e.g., discrepancies in symptoms between weekdays and weekends or during periods away from work). Travel-associated alterations in respiratory symptoms signify environmental sensitivity and corroborate an asthma diagnosis. Table 1 encompasses prevalent asthma imitators and associated symptoms. Further historical information regarding these disorders may be gathered, contingent upon the patient. Specifically, "cardiac asthma," characterized by wheezing due to unrecognized heart failure and ensuing volume overload, along with chronic obstructive pulmonary disease (COPD), must be considered for adult patients with asthma-like symptoms. There exists a possibility that asthma may coexist with these ailments.

VISUAL INSPECTION

The physical assessment is particularly beneficial in identifying any concurrent or mimicking conditions. In cases of asthma, a pulmonary assessment often yields inconclusive results. Despite lacking sensitivity and specificity for this condition, exhalatory wheeze may be present. Inspiratory wheezing is atypical and may suggest an alternative or distinct illness. Analogous to crackles, other potential diagnoses must be considered. Patients could exhibit signs of postnasal drip or simultaneous rhinitis. Eczema can be identified with a dermatological examination. Ultimately, a cardiac evaluation must be conducted to identify indications of heart failure.

DIAGNOSTIC EVALUATION

The subsequent action involves conducting spirometry prior to and following bronchodilator treatment to assess the two primary factors essential for asthma diagnosis: expiratory airflow obstruction and variability in airflow restriction. This is performed when the medical history and physical assessment indicate asthma as a probable diagnosis. A diagnosis of asthma is corroborated by spirometry demonstrating expiratory airflow obstruction and total reversal of this obstruction with bronchodilator therapy. Spirometry often yields normal results when asthma is being managed; nonetheless, the erratic nature of symptoms and airflow limitation remains a significant characteristic of the condition. Moreover, owing to a more acute illness condition at onset or as a result of airway remodeling in persistently uncontrolled asthma, specific asthma. patients who initially have an obstruction of the expiratory airflow may not fully recover after bronchodilator administration. These additional illnesses should be taken into account Partial reversibility is likewise a feature of COPD or the overlap between asthma and COPD. Spirometry cannot consistently distinguish between asthma and COPD in these situations. A ratio of the first-second fractional exhaled volume (FEV1) to the total forced vital capacity (FVC) that falls below the lower limit of normal signifies airflow obstruction. The LLN offsets the expected decline in FEV1/FVC associated with aging and is favored over a fixed threshold (like 70%) as it relies on data from healthy normative populations. Post-administration of a bronchodilator, postbronchodilator response is characterized by an elevation in FEV1 or FVC exceeding 12% and 200 mL. [14]. These benchmarks are established by recommendations that recognize the necessity of considering the clinical context while analyzing test outcomes. For example, although not meeting the 12 percent and 200-mL criteria, a patient demonstrating a 10 percent enhancement in FEV1 post-bronchodilator and an increase in pre-bronchodilator FEV1 following inhaled corticosteroid treatment would exhibit a clinically meaningful response indicative of asthma.[15,16]

Conducting spirometry again at a different period is essential if initial results are normal and clinical suspicion of asthma persists, as it is necessary to document at least one instance of obstruction to substantiate the asthma diagnosis. Serial assessments utilizing a peak flow meter may also serve to record fluctuations in airflow restriction when reversibility is not observable by spirometry. The patient is directed to document the highest of three peak flow attempts twice daily during a span of two weeks, often in the morning and evening, or more often during episodes of respiratory distress. Variable airflow limitation may also be identified through significant variations in peak flow measurements, assessed using a one-week average. Exceeding 10% when the daily mean is calculated by the span of values from maximum to minimum.[15]

A methacholine challenge or other bronchoprovocation assessment for airway hyperresponsiveness exhibits restricted specificity for asthma. This examination has so diminished in utility for asthma confirmation but still serves a purpose in specific demographics to exclude asthma, owing to its elevated negative predictive value, which is said to nearly reach 100%. Airway hyperresponsiveness occurs in several respiratory disorders, such as COPD, and is also observed in the general population, with prevalence rates varying from 4 percent to 37 percent.[17]

The ideal approach involves a phased diagnostic procedure that incorporates spirometry or

peak flow assessment to illustrate both obstruction and fluctuating airflow restriction, unless the patient exhibits acute symptoms. When individuals are on asthma medications, it may be challenging to discern obstruction induced by asthma.[18,19] A recent Canadian study indicates that as many as one-third of individuals diagnosed with asthma by a physician may not genuinely have the condition. The research results highlight the significance of objective assessments in confirming asthma diagnoses, as these individuals were less inclined to have received official evaluations for airflow restriction.[20]

Blood analyzes and imaging studies are generally unnecessary during the diagnostic procedure unless an alternative diagnosis is suspected. Increases in eosinophils, immunoglobulin E (IgE), or allergen-specific IgE lack sensitivity and specificity for the primary diagnosis of asthma, while they are beneficial in diagnosing allergic conditions or when contemplating advanced treatment. While fractional exhaled nitric oxide (FeNO) is frequently unnecessary for asthma diagnosis, it serves as an indicator of eosinophilic airway inflammation.

TYPES OF ASTHMA

Cough serves as the predominant indicator in individuals with cough-variant asthma. [21,22] The cough is thought to be a neurological reaction to bronchoconstriction instead than being caused by mucus production. [23] Individuals in this group generally do not exhibit wheezing, hence the differential diagnosis should encompass alternative illnesses that may lead to chronic cough.

Exercise-induced asthma impacts individuals who exhibit symptoms following vigorous physical exertion due to their airways becoming excessively reactive to cold or arid air during exercise-related hyperventilation.[24] Individuals exhibit standard asthma manifestations promptly after physical activity and persist for as long as an hour thereafter. Asthma that is induced or worsened by medications inhibiting cyclo-oxygenase 1, an enzyme crucial for the degradation of proinflammatory leukotrienes, is referred to as aspirin-exacerbated respiratory disease (AERD). The amalgamation of asthma, sensitivity to aspirin, sinus disorders, and nasal polyps is known as Samter's trifecta. Given that any nonsteroidal anti-inflammatory drugs, not exclusively aspirin, might exacerbate the disease, the designation of the condition may be deceptive. AERD occurs in around 14% of individuals with severe asthma and 7% of the overall asthmatic population; it tends to be more severe and less manageable than other asthma types.[25]

Although vocal cord dysfunction (VCD) is not classified as a type of asthma, it deserves particular consideration as it frequently resembles asthma and may occur alongside it. In VCD, the vocal chords unexpectedly constrict on inhalation, leading to wheezing and shortness of breath. Individuals presenting with sudden onset wheeze predominantly during inhalation, characterized by a short duration and minimal response to asthma medications, have to be assessed for vocal cord dysfunction (VCD).

Therapeutic intervention by a specialist knowledgeable in VCD can be quite advantageous for individuals with VCD, particularly those who also suffer from asthma. Identifying this ailment is essential for administering treatment.

MANAGEMENT

Asthma is characterized by fluctuating symptoms and airway constriction; thus, successful management of the condition requires continuous assessment throughout time to optimize

disease control, address underlying inflammation, and minimize medication side effects. The clinician must assess symptoms, the potential for deterioration, medication tolerance and compliance, as well as concomitant conditions throughout every consultation. For a patient with confirmed or newly diagnosed asthma, technique 2 presents an unconventional sequential strategy. The majority of patients can expect to achieve effective management with superior treatment.

COMPARISON OF THE CONTROL OF ASTHMA AND THE SEVERITY OF ASTHMA

The severity of asthma may be assessed prior to initiating medical treatment, taking into account lung function, symptom frequency, and a history of exacerbations. The categorization of severity into intermittent, mild persistent, moderate persistent, or severe persistent facilitates early therapeutic decision-making. Given that it implies symptoms of greater intensity cannot be sporadic, the categorization of moderate intermittent is no longer recommended. It is essential to recognize that the severity of asthma is not a fixed attribute and must be reassessed at each appointment, with categorization based on the level of medicine necessary to control or alleviate the symptoms of the illness. Variations in asthma intensity could indicate novel environmental exposures, accompanying conditions, or an advancing illness. The severity of asthma indicates the magnitude of the entire disease process.

The management of a patient's asthma, the occurrence of their symptoms, and any associated impacts must be assessed throughout each consultation. EPR-3 and GINA advocate for the utilization of four frequency inquiries to assess control over a span of two to four weeks: days experiencing asthma symptoms, nites disrupted, days with restricted activity due to asthma, and days when a rescue inhaler was employed outside of pre-exercise use.[15,16] If symptoms have persisted for two days or less, the use of a rescue inhaler has occurred for two days or fewer, and there have been no instances of nighttime waking or activity restriction due to asthma in the last two weeks, the illness is considered effectively managed. The Asthma Control Test and the Asthma Control Questionnaire are two self-administered assessments that measure asthma management. These instruments are applicable in clinical environments and exhibit improved sensitivity to identify variations in control over time.[27,28] A patient suffering from uncontrolled asthma is not automatically classified as having severe asthma, despite the expectation that both control and severity may fluctuate over time. Furthermore, several factors, including inadequate inhaler usage, barriers to compliance, persistent exposure to triggers, and relevant comorbidities, may obscure evaluations. All of these matters warrant examination in instances of inadequate oversight. In predicting the likelihood of future exacerbations, the management of asthma holds greater significance than the severity of the condition.

NON-MEDICAL INTERVENTIONS

A vital aspect of asthma management is the removal of triggers. Table 2 enumerates common stimuli along with their corresponding reactions. Individuals with seasonal allergies or sensitivity to air pollution are recommended to remain indoors and shut windows during periods of elevated pollen levels or subpar outdoor air quality. The timing for avoiding pollen is fundamentally reliant on each patient's specific aeroallergen sensitization profile, which need to be determined if there is a notable history of seasonal allergies and a necessity to consult an allergist. Minimizing exposure to indoor allergens, particularly those specific to the

patient, is recommended but difficult to execute due to the complexities of achieving complete allergen elimination and the costs associated with therapies.[33] The importance of evading secondhand smoke and quitting smoking is emphasized.[34,35]

Addressing symptomatic gastroesophageal reflux disease based on the premise that acid reflux could induce bronchoconstriction is a common approach. The management of allergic rhinitis can also be attempted, albeit its impact on asthma for individuals already utilizing ICS may be negligible.[36] Empirical evidence about the effectiveness of enhancing asthma management or severity in adults, conversely, is variable.

Adults with asthma should be administered the PPSV23 vaccine prior to reaching 65 years of age.[38] Aside from that, the advice for adults with asthma mirrors that of healthy adults. Individuals classified as overweight or obese must to be counseled on weight reduction as a component of preserving their overall health, and all individuals should be encouraged to adhere to a nutritious diet.

A reduction in weight ranging from 10 to 15 kg has been linked to enhancements in asthma management and severity, as indicated by interventional research.[39]

PHARMACEUTICAL TREATMENT

The primary classifications of pharmaceutical treatment are maintenance meds and emergency pharmaceuticals. Protocols for managing asthma categorize pharmacological treatment into incremental stages, with elevated tiers indicating more rigorous control therapy. The figure contains a diagram of recommended medications derived from GINA. The source documents include more comprehensive charts with supplementary options.[15,16] Ultimately, standard pre-bronchodilator spirometry must be conducted with careful consideration of FEV1. Prebronchodilator FEV1 measurements beneath the lower limit of normal are typically suggestive of unmanaged illness and elevate the likelihood of a future exacerbation.[30,31] Despite the association between modifying asthma treatment according to sputum eosinophilia or FeNO and a reduction in exacerbations, insufficient data exists to endorse this approach in clinical settings.[32]

CONTROLLED SUBSTANCES

The primary aims of controller therapy are to diminish the inflammation associated with asthma and to prevent the advancement of irreversible airway remodeling. To achieve this objective, all individuals with chronic asthma, including those with mild symptoms, are administered controller drugs. Patients must be made aware that asthma is a persistent ailment and that effective utilization of controller medications is what leads to the absence of asthma symptoms. The notion that "absence of symptoms equates to absence of asthma" is widely recognized to result in suboptimal outcomes.[40]

The cornerstone of controller therapy is inhaled corticosteroids. Oral thrush, which can be mitigated by employing a spacer device and maintaining oral hygiene post-ICS usage, and dysphonia, which has been informally noted to improve by transitioning to an alternative delivery method, exemplify prevalent side effects. If management is insufficient, leukotriene modifiers or long-acting beta agonists (LABA) may be included with ICS, with the former demonstrating greater efficacy than the latter. Long-acting muscarinic antagonists, commonly utilized in COPD, do not seem to surpass LABA as adjunctive treatment in asthma and are generally designated for severe cases.[43,44] Significantly, there exists a definitive contraindication to the use of LABA as a standalone treatment (i.e., without simultaneous

therapy)

RESCUING MEDICINES

Every patient ought to have access to an albuterol rescue inhaler. When administered up to four times a day, this rapid-acting medication provides immediate bronchodilation for individuals experiencing acute symptoms. Albuterol delivered to an adult patient by a nebulizer, a metered-dose inhaler (MDI) without a spacer, or an MDI with a spacer demonstrates equivalent efficacy. Individuals with intermittent asthma can manage their symptoms with solely a short-acting beta-agonist, whereas individuals with persistent asthma (i.e., utilizing their albuterol inhaler more than twice weekly for symptom relief) necessitate the incorporation of inhaled corticosteroids (ICS). In reality, spacers and nebulizers can administer medication with more reliability.[45,46]

It is essential to observe patient compliance and inhaler usage technique. Videos illustrating the correct utilization of an MDI and additional devices can be accessed from the US Centers for Disease Control and Prevention (CDC)49 and the American Lung Association.[50] The assessment of inhaler technique will become increasingly vital as producers create more specialized delivery systems. Up to two-thirds of patients exhibit inaccuracies in MDI utilization, leading to inadequate medication administration and diminished asthma management.

Correspondingly, the examination of medication adherence—the proportion of prescribed doses consumed—warrants attention. If feasible from a logistical standpoint, dosage counters and pharmacy records serve as valuable, impartial sources of adherence data. Studies indicate that there are no reliable factors linked to nonadherence, except for advanced age and conviction in the requirement of medicine, with average adult ICS adherence estimated between 22 percent to 63 percent.[52] Regrettably, a limited number of adherence strategies have demonstrated enhancement in asthma outcomes, underscoring the intricacy of this vital component of treatment.

TREATMENT INITIATION AND MODIFICATION

Expert guidance provides insight on the commencement of medicine for the patient initiating treatment, contingent upon severity evaluation.[15,16]

Deescalation could be considered for a patient who is stable, currently undergoing treatment, and has remained asymptomatic for the last three months. The objective is to identify the therapeutic "floor," facilitating proper evaluation of illness severity, while minimizing the danger of negative effects linked to excessively aggressive therapy. Should there be indications of diminishing control, such as a reduction in peak flow or an escalation in symptoms, the patient ought to be counseled to revert to the elevated treatment tier.

A continuous examination for precipitating factors in the unmanaged patient already undergoing treatment may reveal environmental changes (presenting an opportunity for environmental guidance) or a decline in inhaler compliance (affording a chance to emphasize the necessity of inhaler use and adherence). To regain or assert control, therapy can require a temporary or permanent increase of one to two levels. An inquiry for a different or concurrent diagnosis should be initiated by symptoms that deteriorate and fail to improve with intensified treatment (refer to Table 1).

Due to technical (inability to consistently synchronize actuation with inspiration, necessary for MDI) or physiological (inability to inhale rapidly, essential for dry powder inhalers) factors, a patient may sometimes be transitioned to an alternative delivery device providing the same equivalent medication dosage.

In general, among all patients, there is no definitive preferred delivery method.

TAKING CARE OF ONESELF AND THE ASTHMA ACTION PLAN

Self-management of asthma involves empowering the patient to evade stressors and modify their treatment regimen according to changes in symptoms or pulmonary function. An asthma action plan is fundamental to the self-management of asthma. Patients receive peak flow meters, and during a phase of optimal management, a personal best reading for the device is determined; predictive formulas for peak flows tend to be ineffective, probably due to discrepancies in precision among devices and individuals.[54] Patients monitor their peak flow rates daily or during exacerbations of symptoms, and based on the readings, they are categorized into green (80 percent of personal best), yellow (50 percent - 79 percent), or red (more than 79 percent) classifications. The individual is categorized in the yellow zone if they exhibit any wheezing, coughing, or nighttime disturbances. The individual is categorized in the red zone if they exhibit any critical symptoms, such as an inability to engage in their usual activities or experiencing debilitating shortness of breath. Especially in those who struggle to identify the advancement of their symptoms, a dual approach is recommended.

Interventions in the yellow zone may manifest in several ways, generally encompassing the utilization of a rescue inhaler, notifying a physician, potentially augmenting the dosage of a controller medication, and initiating an oral corticosteroid if symptoms and peak flow fail to normalize within a specified duration. In the yellow zone, increasing ICS twofold appears ineffective, yet increasing it fourfold does. The utilization of ICS has been shown to diminish the likelihood of transitioning to oral corticosteroids or experiencing an acute asthma visit by 20%, but at the expense of heightened dysphonia and oral thrush.[55] Individuals in the red zone ought to use their rescue inhaler immediately, reach out to their physician, or proceed to the emergency department. Physicians may consider intensifying the controller therapy relative to the preexacerbation protocol.

The CDC, the National Institutes of Health, and the American Lung Association provide templates for asthma action plans.[56] Employing peak flow assessment or symptomatology to direct management seems to be largely comparable.[57] Self-regulation techniques have demonstrated efficacy in averting exacerbations, reducing asthma-related healthcare usage, and enhancing overall quality of life.[58,59,60]

ALTERNATIVE THERAPIES FOR SEVERE ASTHMA

For advanced treatments of severe asthma, it is advisable to visit a pulmonologist and/or an allergist-immunologist. Supplementary treatment alternatives could be required.[61] Recent advancements in biologic therapy have resulted in the emergence of various innovative drugs for severe asthma. These medications are frequently administered alongside a subspecialist, with their indications determined by individual patient traits. Prevalent objectives encompass the allergic inflammatory cascade.

Omalizumab, an immunoglobulin antibody that specifically targets serum IgE, engages with mast cells, eosinophils, and basophils during the allergic response. It is sanctioned for individuals with moderate to severe asthma exhibiting confirmed allergen sensitivity and whose symptoms remain uncontrolled by inhaled corticosteroids (ICS), administered biweekly to every four weeks. Mepolizumab, benralizumab, and reslizumab are monoclonal antibodies that inhibit the interleukin-5 pathway, crucial for eosinophil recruitment and activation.[63,64,65] Mepolizumab, benralizumab, and reslizumab are administered subcutaneously, whereas reslizumab is given intravenously, every 4 to 8 weeks in clinical environments to individuals with severe asthma and ongoing eosinophilia. Subcutaneous immunotherapy has demonstrated a reduction in asthma severity, the reliance on systemic corticosteroids, and the frequency of rescue inhaler utilization in individuals with challenging asthma and significant allergies. There exists a minor risk of anaphylaxis; however, the literature lacks sufficient data to assess its extent and seriousness. Bronchial thermoplasty (BT) is an endoscopic technique that utilizes radiofrequency thermal radiation to ablate airway smooth muscle, thereby diminishing its ability to induce bronchoconstriction.[67] Research indicates that BT diminishes exacerbations, lowers asthma-related healthcare usage, and enhances the quality of life for those with severe asthma.[68]

RISK EVALUATION AND MONITORING

The probability of a subsequent asthma exacerbation or adverse consequences is assessed at the conclusion of the appointment. Key factors now regarded encompass unmanaged illness, anomalous FEV1 levels, unregulated ongoing exposure to an identified personal trigger, and past exacerbations requiring hospitalization or intubation. Individuals displaying one or more of these traits, including those whose treatment was altered during the present appointment, ought to have a follow-up scheduled within a brief timeframe, generally between two to six weeks. If therapy is refined and the disease is stable, people with lower risk may have their visits scheduled every six months or annually. While the optimal interval for repeated lung function assessments remains uncertain, there is a consensus that such evaluations should occur every one to two years for patients with stable conditions, with a specific focus on the emergence of fixed obstruction, indicative of persistently inadequate management.

ACUTE ASTHMATIC EXACERBATIONS IN PATIENTS

A thorough history and physical assessment will effectively direct treatment for the outpatient experiencing a sudden exacerbation of asthma symptoms. Based on historical

context, inquiries ought to be made concerning recent sick contacts, sudden cessation of controller medications, and exposure to personal asthma triggers. The predominant cause of acute exacerbations is viral respiratory infections, especially rhinovirus.[69] The pace at which symptoms decline ought to be documented. The evaluation should consider the patient's comprehensive respiratory condition together with any symptoms associated with infections. Concerning indicators comprise hypoxemia, utilization of accessory muscles, inspiratory and expiratory wheezing, and the lack of wheezing associated with respiratory distress. Serial peak flow assessments must to be conducted before to and subsequent to in-office albuterol administration, provided the patient is capable of safely executing respiratory exercises and does not necessitate urgent emergency referral. In a straightforward exacerbation, radiographic irregularities are rare, and chest imaging is seldom performed. The optimal approach for delivering albuterol seems to be 2.5-mg doses every 20 minutes (for nebulizers) or 3 to 5 inhalations (for MDIs) every 10 minutes, not exceeding 3 times.Seventy nebulizers and metered-dose inhalers (with spacers) exhibit comparable efficacy when utilized in acute circumstances.71, 72 Oral corticosteroids constitute the primary therapy for asthma exacerbations and address the underlying inflammatory reaction, alongside the avoidance of trigger exposure. Typically, tapering is unnecessary for prednisone dosages above 40 to 100 mg daily or lasting more than 5 to 10 days.[73] Patients can recommence their green zone treatment regimen if symptoms and peak flow have reverted to baseline following the cessation of corticosteroids and the precipitating event can be circumvented. If not, maintenance therapy may need to advance to the next step of the treatment pyramid while waiting for a reevaluation, or in some instances, oral corticosteroids may be prolonged.

Notwithstanding progress in the standardization of asthma management, the choice to direct a patient to the emergency department remains a clinical judgment, considering the patient's capacity to handle essential outpatient treatments alongside their disease progression and possible future trigger exposure. Following an exacerbation, patients ought to be assessed within a fortnight to reassess their symptoms, pulmonary function, and appropriateness of their existing controller medication. Exacerbations of asthma, especially those necessitating hospitalization or emergency treatment, have been associated with long-term deterioration in pulmonary function, hence prioritizing prevention is essential.

SPECIALIST REFERRAL INDICATES

The predominant instances of asthma can be effectively controlled within primary care with appropriate training.[76] In certain cases, it may be essential to refer a patient to a specialist, especially for those with severe or chronically uncontrolled asthma or for individuals with an unclear asthma diagnosis. Box 1 encompasses standard referral criteria. The engagement of specialized care, whether in pulmonology or allergy management, has been associated with improved results.[76,77]

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Common indications for specialist referral

Alternative pulmonary diagnosis suspected

Asthma diagnosis suspected, but confirmation elusive

Possible occupational asthma

Persistently uncontrolled disease

More than 1 exacerbation in past year

History of life-threatening exacerbation

Difficulty with medication selection

Difficulty managing asthma due to comorbidities

Severe disease requiring specialized therapy

KEY POINTS

- Asthma may become clinically apparent at any age, but exclusion of diseases that mimic asthma is especially important in older individuals.
- A confident diagnosis of asthma can be made with demonstration of reversible obstruction on spirometry, and the risk of misdiagnosis is higher in the absence of this objective information.
- Inhaled corticosteroids are the cornerstone of pharmacologic asthma treatment of persistent disease, with additional therapies added on the basis of inadequate disease control.
- Patients should be empowered to respond to changing symptoms through use of an asthma action plan.
- Specialist referral is indicated for individuals with severe or difficult-to-control asthma; however, most individuals with asthma are successfully managed in the primary care setting.

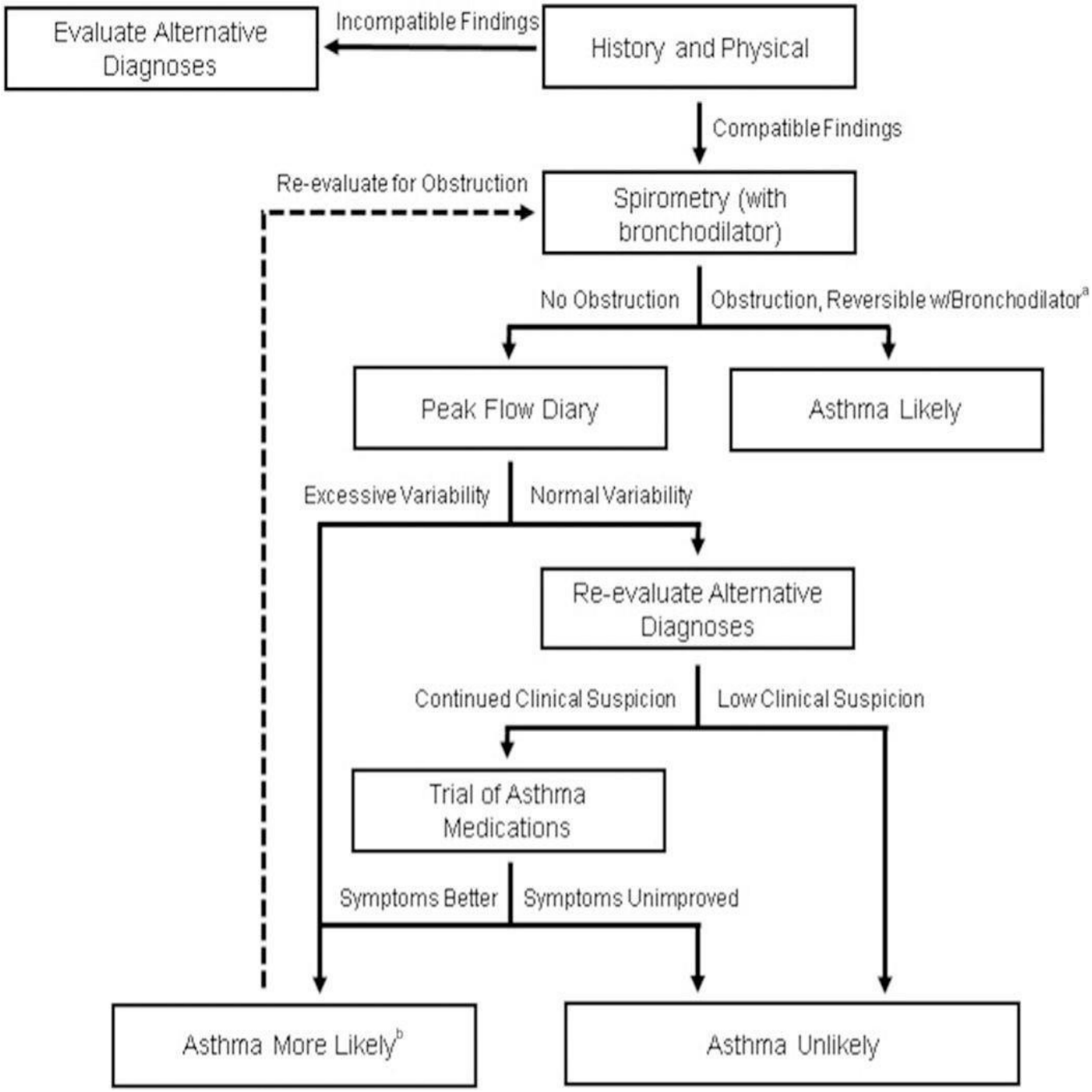

History and Physical
Incompatible Findings
Evaluate Alternative Diagnoses
Compatible Findings
Spirometry (with bronchodilator)
Re-evaluate for Obstruction
No Obstruction
Obstruction, Reversible w/Bronchodilator[a]
Peak Flow Diary
Asthma Likely
Excessive Variability
Normal Variability
Re-evaluate Alternative Diagnoses
Continued Clinical Suspicion
Low Clinical Suspicion
Trial of Asthma Medications
Symptoms Better
Symptoms Unimproved
Asthma More Likely[b]
Asthma Unlikely

Fig. 1

Iterative evaluation of a patient with suspected asthma. [a]Bronchodilator responsive-ness is defined as an improvement in FEV1 or FVC by greater than 12% and greater than 200 mL. Patients may have improvement that does not meet this threshold and still benefit from bronchodilator therapy. Reversibility implies that spirometry improves to normal after bronchodilator. If only partially reversible, consider possibility of COPD, asthma-COPD overlap, or severe asthma. [b]Probability of asthma is substantially increased with the finding of obstruction at least one time on spirometry; reevaluation should occur at regular intervals. The likelihood of identifying obstruction while already on asthma medications is lower.

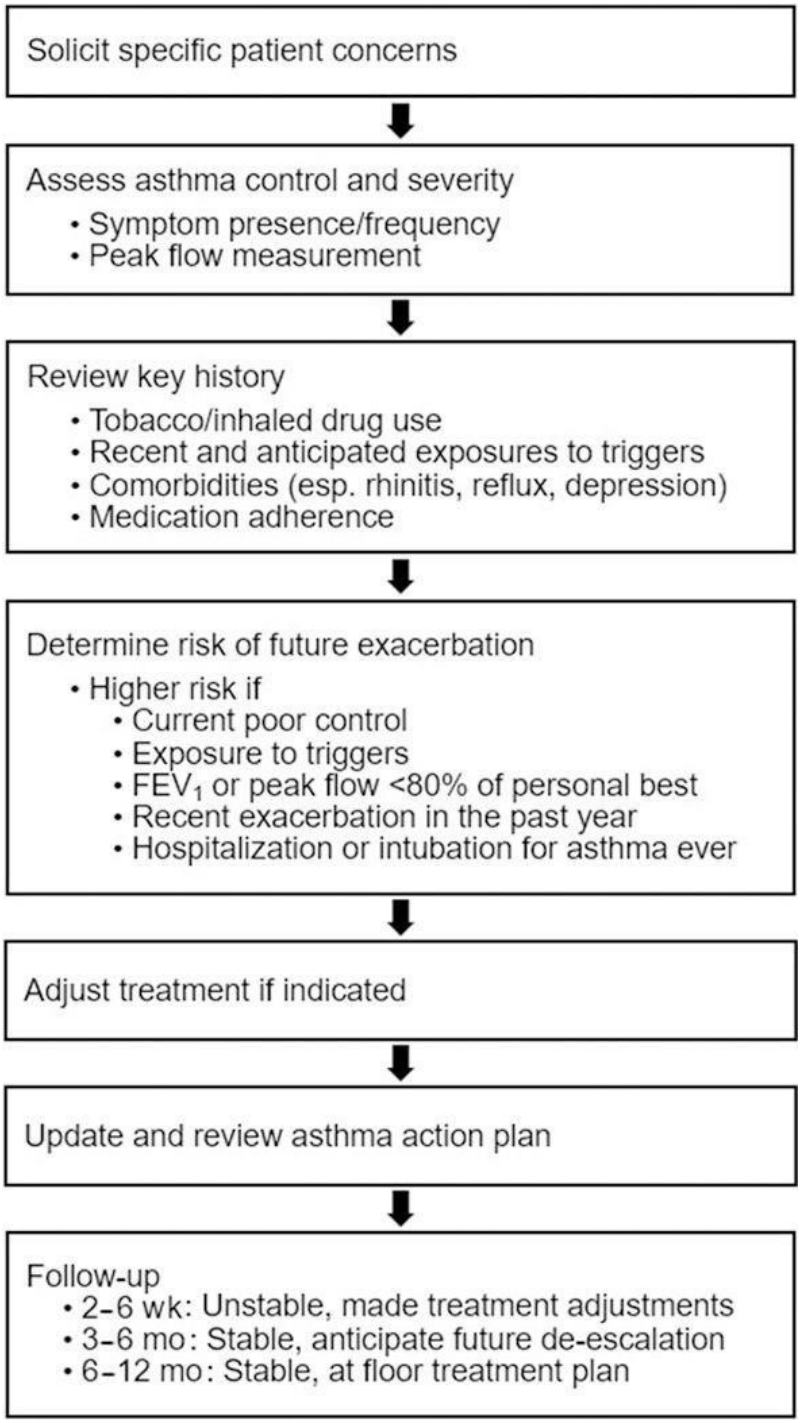


Fig. 2.Progression of an outpatient visit for asthma.

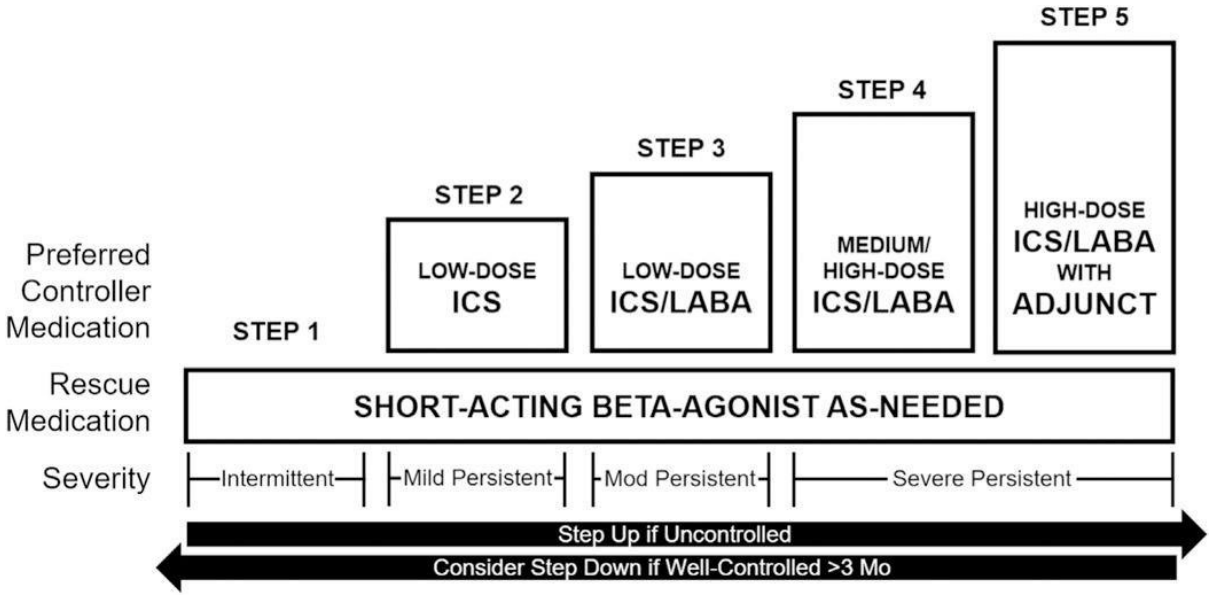


Fig. 3.

Steps of asthma pharmacologic treatment. Adjunct therapies include a long-acting muscarinic antagonist or biologic therapies in selected populations. Immune therapy may be considered for persistent asthma (steps 2–5). Leukotriene modifiers may be considered as analternative to LABA but are generally less effective. Mod., moderate. *(Adapted from* Bateman ED, Hurd SS, Barnes PJ, et al. Global strategy for asthma management and prevention: GINA executive summary. Eur Respir J 2008;31(1):157; and National Asthma Education and Prevention Program. Expert panel report 3: guidelines for the diagnosis and management of asthma. Washington (DC): US Department of Health and Human Services, National Heart, Lung, and Blood Institute; 2007. p. 343; with permission.)

Table 1.Differential diagnoses in a patient presenting with asthmalike symptoms

Condition	Associated Signs and Symptoms
Allergic bronchopulmonaryaspergillosis	Infiltrates, mucus plugging, bronchiectasis, elevated serum total IgE, and sensitizationto *Aspergillus* (either skin testing or by specific IgE)
Bronchiectasis	Productive cough, history of recurrent pulmonary infections
Carcinoid syndrome	Episodic flushing, diarrhea, emesis
COPD	History of smoking or biomass exposure (especially in those residing in rural areas), irreversibleobstruction on spirometry
Congestive heart failure	Pulmonary crackles, lower extremity edema, jugular venous distension, family or personal history ofcardiovascular disease
Eosinophilic bronchitis	Chronic cough, upper airway symptoms, no hyperresponsiveness
Eosinophilic granulomatosis withpolyangiitis	Migratory pulmonary infiltrates, concurrent sinus disease, antineutrophil cytoplasmic antibodies
Foreign body aspiration	Localized area of wheeze, segmental atelectasis on computed tomography (CT) scan
Interstitial lung disease (ILD)	Infiltrates, reticulation, or frank fibrosis on CT scan; signs and symptoms vary with ILD type; hypersensitivity pneumonitis and cryptogenic organizing pneumonia are types of ILD with atopicassociation
Postnasal drip	History of rhinitis and sinusitis, but no variable airflow obstruction
Tracheal stenosis/ tracheomalacia	Tracheal narrowing on CT scan, history of intubations
VCD	Sudden onset of dyspnea, prominent inspiratory wheezing, blunting of the inspiratory limb of the flow- volume loop

Table 2.Common asthma triggers and suggested remediation strategies

a **Trigger**	**Strategies**
Ambient air pollution	Remain indoors during poor air quality days
Certain foods	Test for food-specific allergies, avoidance

Cigarette smoke	Smoking cessation assistance, home smoking ban
Cockroaches	Sweep and vacuum regularly, use roach traps
Combustion smoke	Avoid use of wood-burning fireplaces
Dust mites	Use mattress and pillowcase covers, avoid down-filled pillows and blankets, wash bedding regularly
Emotional distress	Address comorbid depression, involve behavioral specialists
Fragrances	Avoidance
Indoor air pollution	Reduce source exposure (eg, perform maintenance to reduce NO_2 from appliances, such as gas stoves and gas heaters); routinely change central air filters; portable air purifiers
Molds	Address leaks, reduce home humidity
Pets	Remove or keep pets outdoors
Pollens	Remain indoors during morning through midday when specific agent is pollinating
Weather events (eg, rain, heat)	Remain indoors during weather events

[a]Trigger-specific strategies should only be suggested if patient is sensitive to that trigger; each patient will have different patterns of asthma triggers.