

commonly methacholine, is applied to the patient's airway. Methacholine, a synthetic form of acetylcholine, is preferred to histamine because there are fewer systemic side effects. Exercise can also be used to trigger an attack. Although most patients with or without asthma develop some degree of airflow limitation during bronchoprovocation testing, those with asthma develop airflow limitation at much lower doses. For methacholine challenge, the concentration of methacholine required to produce a 20% decline in FEV₁ from baseline is reported. Although a positive bronchoprovocation challenge result is not by itself diagnostic of asthma, a negative result is helpful in ruling out asthma as a diagnosis.

Lung volume measurements may show hyperinflation during active disease, but the DLCO is typically normal or even elevated. During acute exacerbations of asthma, analysis of arterial blood gases is useful to determine gas-exchange status. A chest radiograph should be obtained if a concern for pulmonary infection exists, but routine chest radiography is not necessary. Fleeting or migratory infiltrates on chest radiographs in a patient with difficult asthma should suggest the possibility of allergic bronchopulmonary aspergillosis. Blood tests in asthma might reveal eosinophilia and increased levels of IgE. Skin tests might be useful to identify household products or other antigens that could precipitate asthma attacks in a specific patient.

The differential diagnosis includes tracheal disorders, respiratory tract tumors and foreign bodies, COPD, and bronchiectasis. In patients whose primary presenting complaint is chronic cough, the differential diagnosis includes other causes of chronic cough, such as GERD and postnasal drip. A major differential consideration in patients not responding to typical asthma treatment is vocal cord dysfunction.

Treatment

The management of asthma requires education and cooperation on the part of the patient. Simple, inexpensive peak expiratory flow meters can be used at home to monitor airflow obstruction. A diary should be maintained, and a clear written plan should be in place for using symptoms and peak flow information to intervene early in exacerbations and to alter long-term therapy for optimal control of symptoms. Short-acting β -agonists are used for acute relief of symptoms such as wheezing (level 1 evidence). However, the cornerstone of maintenance therapy in all but mild intermittent asthma is administration of inhaled corticosteroids, which are highly effective in improving asthma control (level 1). Long-acting β -agonists may be added for additional symptomatic control as needed (level 1). LABAs should not be used as a monotherapy for asthma control because they do not control airway inflammation and increased mortality has been demonstrated with this therapeutic approach (level 1). However, these medications may be added to inhaled corticosteroids to provide additional symptom control.

Alternatively, leukotriene modifiers can be used in maintenance therapy (level 1 evidence), although they appear to be somewhat less effective than inhaled corticosteroids (see Fig. 16-4). Theophylline preparations may have additional beneficial effects in some patients, but the narrow therapeutic window and modest efficacy of these preparations limit their value. Recent evidence suggests that use of long-acting anticholinergics in


patients with poor control on LABAs and inhaled corticosteroids may increase the time to exacerbation and provide additional bronchodilation (level 2). Oral or intravenous corticosteroids are used during acute asthma exacerbations. Long-term use of oral corticosteroids should be avoided, if possible, given the various side effects associated with chronic glucocorticoid administration.

Allergen avoidance is a reasonable measure in asthma, although the effects of specific interventions, such as mattress barrier protection to reduce dust mite exposure, appear limited. Treatment of associated conditions that may exacerbate asthma, such as allergic rhinitis and GERD, may be clinically beneficial and may aid in achieving asthma control. Use of recombinant human anti-IgE monoclonal antibody may be effective at reducing exacerbations in certain patients with allergic asthma (level 2 evidence). Therapies targeting other specific cytokines involved in asthma remain under active investigation. Bronchial thermoplasty is a new endoscopic technique in which radiofrequency energy delivered in a series of treatments is used to destroy airway smooth muscle. It has been shown to reduce exacerbations and improve quality of life in the months following treatment (level 2).

Acute severe asthma, or status asthmaticus, is an attack of severe bronchospasm that is unresponsive to routine therapy. Such attacks may be sudden (hyperacute asthma) and can be rapidly fatal, often before medical care can be obtained. In most cases, however, patients have a history of progressive dyspnea over hours to days, with increasing bronchodilator use. Treatment of status asthmaticus should be aggressive, including administration of nebulized bronchodilators and intravenous steroids and continuous monitoring of blood oxygen saturation by pulse oximetry, often supplemented by arterial blood gas analysis to evaluate for hypercarbia. A rising PaCO₂ in a patient with asthma is an ominous sign and may portend need for ventilatory support. Noninvasive ventilation has been used successfully to decrease the work of breathing and avoid the need for endotracheal intubation in patients with exacerbations of asthma, but intubation and mechanical ventilation are necessary for the management of respiratory failure in status asthmaticus. Mechanical ventilation of the patient with status asthmaticus can be extremely challenging and may require the use of paralytic agents to control the breathing pattern or even use of inhaled general anesthesia to relieve bronchospasm.

Prognosis

The prognosis in most patients with asthma is excellent. Although there is no cure, most patients can achieve appropriate control of their asthma.

 For a deeper discussion on this topic, please see Chapter 88 ("Chronic Obstructive Pulmonary Disease"), Chapter 87 ("Asthma"), Chapter 89, ("Cystic Fibrosis"), and Chapter 90 ("Bronchiectasis, Atelectasis, Cysts, and Localized Lung Disorders") in Goldman-Cecil Medicine, 25th Edition.

SUGGESTED READINGS

Buist AS, McBurnie MA, Vollmer WM, et al; on behalf of the BOLD Collaborative Research Group: International variation in the prevalence of