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Asthma in the Elderly

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Asthma in the Elderly

Learning Objectives

● Define the term "asthma" and identify its prevalence in the United States

● Identify how asthma is diagnosed in the elderly

● Identify how asthma is treated in the elderly

● Identify the medications used in treating the elderly

Asthma is a common disease in the general population, with an overall prevalence in the US in 2002 of 7% reported by the National Center for Health Statistics.[1] It is caused by a complex interaction of inflammatory cells, mediators, and cytokines, which can induce bronchoconstriction and, as a result, airflow obstruction.[2]

This is a cardinal feature of asthma at any age. There is a common misperception that asthma is predominantly a childhood disease. However, in a survey of elderly persons from four communities in the US, the prevalence of physician-diagnosed asthma was 4%, with another 4% having probable asthma (symptoms of asthma without a diagnosis).[3] This is similar to other estimates that 7–9% of individuals over the age of 70 have asthma. New-onset asthma is most common in childhood, but it may occur at any age, even in the eighth and ninth decades of life. It is often under-recognized or misdiagnosed in the elderly. A proper evaluation of asthma symptoms can lead to early diagnosis, proper treatment, and avoidance of unnecessary emergency department visits and hospitalizations.[4,5]

The Diagnosis of Asthma in the Elderly

Unfortunately, the diagnosis of asthma is frequently overlooked in the geriatric population. Some elderly patients are reluctant to admit their symptoms, or consider them a result of normal aging. Under-reporting of symptoms in the elderly may have many causes, including depression, cognitive impairment, social isolation, denial, and blaming of symptoms on other comorbid illnesses. Even when symptoms are reported, lung function testing to confirm the diagnosis is often not carried out.[6]

On the other hand, the diagnosis of asthma is frequently confused with chronic obstructive pulmonary disease (COPD),[7] a disease usually, but not always, associated with cigarette smoking.

Both are associated with symptoms of shortness of breath, wheezing, cough, sputum production, and airflow obstruction on pulmonary function testing. In one study of a group of elderly asthmatic patients (mean age of 73 years), only 53% of patients had been correctly identified as having asthma. Furthermore, 19.5% of patients were given the wrong diagnosis of COPD.[7] These patients were more likely to have their onset of symptoms later in life and have greater degrees of disability.

The presence of airflow obstruction can be confirmed by spirometry showing a reduced forced expiratory volume in one second (FEV_1) and ratio of FEV_1/forced vital capacity (FVC). A ratio of less than 70% increases the probability of asthma in an elderly patient with asthma symptoms. A brisk response to a short-acting bronchodilator may demonstrate the second cardinal feature of asthma: reversible airflow obstruction ('a responder'). When airflow obstruction is found in an elderly patient, attempts should be made to demonstrate reversibility following the inhalation of a short-acting beta adrenergic agent such as albuterol. Age is not a significant predictor of the acute bronchodilator response in asthma. Using American Thoracic Society (ATS) criteria (the post-bronchodilator FEV_1 increases by more than 12% and 200cc), the probability of asthma is significantly increased. Some experts feel this confirms the diagnosis of asthma.[8] While the response to an inhaled bronchodilator is generally greater with asthma (16 versus 11%), many patients with COPD will also meet the ATS reversibility criteria on any given testing day. However, this response may not persist—52.1% of patients will change 'responder' status between visits.[9] This makes the test less than reliable to confirm the diagnosis of asthma.[10,11] If complete reversibility of airflow obstruction is documented, COPD, a disease of fixed airway obstruction, is excluded. A brisk post-bronchodilator response enhances the post-test probability of asthma.

A negative bronchodilator response to a short-acting beta agonist, on the other hand, does not rule out a diagnosis of asthma. Population studies have shown that as many as 30% of patients with fixed airflow obstruction have a past history of asthma.[12] Often, treatment over time will improve lung function and, when documented by spirometry, a diagnosis of asthma can be confirmed. Measurements of the FEV_1 over time may offer the best way of making the diagnosis.

Fixed Airflow Obstruction in Elderly Asthmatics

In addition to bronchoconstriction, causes of airflow obstruction are mucous plugging, bronchial wall edema, inflammatory cell infiltration, airway smooth muscle hypertrophy, and subepithelial fibrosis. All of these architectural changes are collectively referred to as 'airway remodeling.' While some of these changes may be reversible with treatment, at some point they may become permanent, and this results in fixed airflow obstruction.

There is growing evidence that the airway function of young and middle-aged asthmatics declines at a greater rate than that of normal subjects.[13] The rate of decline increases with increasing age and in those who smoke cigarettes.

These effects are variable since not all individuals show a steeper rate of decline. A longer duration and severity of previous asthma are also important factors.[14,15] In one random survey of 1,200 elderly asthmatics over the age of 65 years, only one in five patients had normal pulmonary function (FEV_1 >80% predicted), while a similar number showed moderate to severe airflow obstruction (FEV_1 <50% predicted) after an inhaled short-acting bronchodilator.[16] Since structural changes of emphysema are minimal in elderly asthmatics, airway remodeling is thought to be the main cause of fixed airflow obstruction.[17]

While distinguishing asthma from COPD may be very challenging, there are features seen in elderly asthmatics with fixed airflow obstruction that are distinct from COPD caused by cigarette smoking. When compared with patients with COPD of similar age, they have significantly more eosinophils in the peripheral blood, sputum, and bronchoalveolar lavage (BAL), and on bronchial biopsy have higher numbers of neutrophils in the sputum and BAL, have higher ratios of CD4+/CD8+ T cells infiltrating the airway, and have greater thickness of the airway basement membrane than patients with COPD.[18] Other distinguishing features include higher levels of exhaled nitric oxide, lower emphysema scores on high-resolution computed tomography (CT) scans, and higher diffusing capacities. Since many of these tests are impractical, not available for widespread use, or not discriminatory enough for clinical use, the most recent American Thoracic Society (ATS)/European Respiratory Society (ERS) Statement on COPD stated: "Some patients with asthma cannot be distinguished from COPD with the current diagnostic tests. The management of these patients should be similar to that of asthma."[19]

While the main diagnostic challenge with asthma in the elderly is distinguishing it from COPD, many current or former smokers have both asthma and COPD. Also, asthma in the elderly may be mimicked by, and often confused with, other diseases, such as congestive heart failure, chronic aspiration, gastroesophageal reflux, and tracheobronchial tumors.[20]

Treatment of Asthma in the Elderly

There are both short-term and long-term therapeutic objectives for every asthmatic patient, recommended by the National Heart, Lung, and Blood Institute (NHLBI).[21] Short-term objectives are the control of immediate symptoms and improvement in lung function. Long-term objectives are those directed to disease prevention and avoidance of emergency room visits and hospitalizations. In order to meet these therapeutic objectives, four components of asthma care should be addressed.

The first of these is monitoring lung function with peak flow meters and/or office spirometry, which is essential in caring for many elderly asthmatics. Older patients with asthma have been shown to deteriorate for longer periods prior to hospital admission for severe acute asthma than younger patients. For example, twice as many elderly patients will show worsening symptoms for more than 14 days before hospital admission compared with a group of younger patients. One reason for this delay may be the blunted perception of breathlessness that has been found in the elderly compared with younger patients.[22]

The second component—treatment of asthma with bronchodilator and anti-inflammatory medication—is initially tailored to the patient's needs, and relies on an international staging system of 'asthma severity,' which is based on symptoms and objective measures of lung function.[21] Inhaled corticosteroids are the preferred anti-inflammatory agent, and are given to those patients who have asthma symptoms and require a short-acting beta agonist for rescue therapy more than twice a week. Monitoring the response to treatment by an assessment of 'asthma control' will be incorporated into the new NHLBI guidelines, as they are in the new Global Initiative for Asthma (GINA) Guidelines.[23]

Third, measures should be taken to avoid respiratory irritants that can cause worsening of symptoms. This third cardinal feature of asthma, bronchial hyper-responsivenes, can be demonstrated as an exaggerated bronchoconstrictive response of the airways to a variety of stimuli, such as aeroallergens, histamine, methacholine, cold air, and environmental irritants. Important provocative factors in the elderly include viral respiratory infections, respiratory irritants, and beta adrenoreceptor antagonists (betablockers), which are commonly used in this age group for ischemic heart disease, arrhythmias, and hypertension.

Finally, patient education can be a powerful tool in asthma control. Family members can also be helpful, especially with elderly adults. Active participation by a patient in monitoring lung function, avoiding provocative agents, and making decisions regarding medications provides asthma management skills that give a patient the confidence to control his or her own disease.

Medication for Asthma

The medications used to treat the elderly asthmatic are the same as those used to treat younger patients. Inhaled short-acting $beta_2$ adrenergic agonists are the treatment of choice for the acute exacerbation of asthma symptoms. They can be delivered by metered-dose inhaler (MDI) and compressor-driven nebulizers. Unfortunately, many elderly patients are unable to use the MDI properly, even after proper instruction. Inadequate timing of actuation and inhalation is the most frequent error made. Impaired mental function, weakened or deformed hands, and motor or musculoskeletal diseases are other reasons for inadequate MDl use. Despite the minimal systemic absorption seen with the beta agonists, tachycardia and tremor may be observed. While they have been proved to be safe and effective in all age groups, the relative risks for adverse cardiovascular events is high, and caution should be used with these agents in those patients with underlying cardiac conditions.[24]

Long-acting $beta_2$ agonists such as salmeterol and formoterol are helpful for long-term maintenance therapy, and should be used in conjunction with an inhaled corticosteroid to improve asthma control.

The goal of asthma therapy is always to control the disease without systemic steroids. Inhaled corticosteroids are safe and effective treatment for elderly asthmatics.

They can reduce airway inflammation after several months of treatment, but long-term treatment is usually necessary. Longterm use of inhaled corticosteroids has been associated with a good safety profile. They are not associated with an increased risk of fractures at standard doses. High doses of inhaled steroids (>1000mcg per day) are capable of causing hypophyseal-pituitary-adrenal (HPA) axis suppression and systemic complications. Local adverse effects, such as hoarseness, dysphonia, cough, and oral candidiasis, do occur, but can usually be avoided by the use of a spacer or holding chamber.

Prognosis

Longitudinal studies of asthmatic populations have shown that remission from asthma is uncommon in older age groups, occurring in about 20% of patients. Elderly asthmatics with severe symptoms, long-standing disease, reduced pulmonary function, or a concomitant diagnosis of COPD are much less likely to have a remission. The risk for hospitalization in the asthmatic over the age of 65 doubles compared with younger patients, especially for women and non-whites.[25] In one study, the risk of rehospitalization was 23% after one year, and 12% of patients died.[26] Asthmatics over the age of 65 years account for 60% of asthma-related deaths overall, and black females aged 65 years and older have the highest crude asthma mortality rates.[27] Despite the at times severe symptoms and physiological impairment, most elderly patients with asthma can lead active productive lives with the use of appropriate therapy.[5]

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The National Asthma Education and Prevention Program's "Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma" apply to all ages. This review discusses additional specific points for elderly patients. These patients are very heterogeneous. Their asthma can have begun at any time and can vary greatly in severity. It is frequently associated not only with any of the diseases that affect older persons but also with comorbid lung diseases. Many patients have irreversible airway obstruction, which is due to severe airway remodeling, chronic obstructive pulmonary disease, or bronchiectasis. Diagnosis should include chest radiography and computed tomographic scanning to diagnose other lung diseases if FEV(1) remains low after treatment. Asthma pathogenesis includes not only IgE-mediated allergy but also innate immune inflammation from endotoxin and trypsin-like proteases, and therefore evaluation and control of environmental exposures is an important part of management. Pharmacologic treatment, too, is adjusted to achieve and maintain control and is basically the same for all ages, except that elderly patients have reduced response to bronchodilators and increased side effects from beta adrenergic agonists and glucocorticoids. Many elderly patients have difficulty inhaling aerosols, and therefore nebulizers might be a better delivery system. Oral medications have the benefit of greater ease of administration and greater efficacy on the peripheral airways. Leukotriene antagonists and low-dose theophylline are often helpful additives to aerosol glucocorticoids. Oral glucocorticoids might be indicated for severe asthma.

Asthma in the Elderly

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Bronchial asthma is a common problem with enormous medical and economics impacts. It is an inflammatory disease of the airways associated with intermittent episodes of bronchospasm. Asthma is not uncommon in the elderly patients. Prevalence of asthma is similar in older and younger adults. Asthma in the elderly patient is underdiagnosed because of false perceptions by both patient and physician. The high incidence of comorbid conditions in the elderly patient makes the diagnosis and management more difficult. Correct diagnosis is demonstrated with spirometry. The goals of asthma treatment are to achieve and maintain control of symptoms and to prevent development of irreversible airflow limitation. Asthma drugs are preferably inhaled because this route minimizes systemic absorption and, thus, improves the ratio of the therapeutic benefit to the potential side-effects in elderly patients.

Asthma is an inflammatory disorder of the airway associated with airflow obstruction and bronchial hyperresponsiveness that varies in severity across the spectrum of the disease. The overall prevalence of asthma in adults and children varies between countries, with estimates of 7% in France and Germany, 11% in the USA, and 15%–18% in the United Kingdom [1]. Although asthma has been considered, for many years, a disease for childhood or young adulthood, its prevalence is similar in older and younger people [2]. An incidence study demonstrated rate of newly diagnosed asthma of 0.1% a year in those over 65 years of age [3]. Elderly asthmatic patients mainly include subjects who acquired the disease during childhood or adolescence and whose disease progressed over time or relapsed after periods of remission (Elderly asthmatic, long duration); however, the first manifestations of asthma may also occur in the late adulthood or after 65 years of age (elderly asthmatic, late onset) [4].
Little is known about the natural history of asthma in elderly patients, but there is evidence in literature that the elderly asthmatic patient is underdiagnosed [5, 6], undertreated [5, 6], has un higher risk of hospitalization, has a lower quality of life, and experiences greater morbidity and mortality [7]. Underdiagnosed and undertreated of asthma in the elderly may be due to diagnosis misclassification or under-reporting of symptoms [8]. Underestimation of the prevalence of asthma may be due to confusion with chronic obstructive pulmonary disease (COPD) [5].

The underdiagnosis may occur because of an age-related reduction in perception of shortness of breath [9]. In elderly patients there is a close relationship between the severity of wheezing complaints and impairment of the forced expiratory volume in 1 second (FEV1). Elderly patients with long-standing asthma have more severe airway obstruction than patients with recently acquired disease [4] but patients with newly diagnosed asthma experienced a more rapid rate of decline FEV1 than patients with chronic asthma [10]. Elderly patients did not show the elevated rate of allergy skin tests reactivity or high serum IgE levels [11]. However, elderly asthmatic patients have more evidence of atrophy than age-matched controls without asthma as determined by increased immunoglobulin E (IgE) levels and positive skin test [12]. Inhaled corticosteroids (ICSs) have been show to slow this decline [13–15]. One can speculate, then, that if aggressive anti-inflammatory therapy had been started earlier in the course of the disease, some of this damage to the airways may have been prevented.

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread, but variable, airflow obstruction within the lung that is often reversible spontaneously or with treatment [13]. Asthma is suggested by characteristic history of recurrent episodes of wheezing, breathlessness, chest tightness, and/or cough especially at night or in early morning. The certainty that asthma is correct diagnosis is increased when either clinic spirometry or pulmonary function tests demonstrate airflow obstruction that improves significantly, defined as both a 12% and 200 mL improvement in either FEV1 in response to inhaled bronchodilator [16]. However some studies indicate that an increase ≥ 10% of the predicted FEV1 after inhalation of a short-acting bronchodilator may be less subject to bias than measuring percent change from baseline and may have a higher likelihood of separating patients who have asthma from those who have COPD [17, 18]. Spirometry before and after using a bronchodilator should be an essential investigation although it may be difficult to perform in the elderly. In spite of all that in the SARA study Bellia et al. are obtained, in terms of acceptability and reproducibility of FEV1 in the vast majority of patients (aged 73 ± 6, 4 years) [19]. Measurement of airways responsiveness to methacholine in specialized pulmonary function laboratories may help to diagnose asthma [20].

Conventional assessment of asthma severity has combined assessment of symptoms, amounts of β-2 agonist used to treat symptoms, and lung function (Table 1). Asthma is classified as follows: Step 1: intermittent, with symptoms occurring less than once a week and patients remaining asymptomatic with normal peak expiratory flow (PEF) between attacks; Step 2: mild persistent, with symptoms occurring more than once a week, but with < 1 attack · day^{-1}; Step 3: moderate persistent, with daily attacks affecting activity, and Step 4: severe persistent, with continuous limited physical activity [13]. Before treating elderly patients with asthma, some other factors should be considered. Elderly patients with suspect asthma require a rigorous and systematic approach to their diagnosis and treatment. The first step in the care of these patients is evaluation and testing directed at determining that asthma is the correct diagnosis. There are a number of reasons why asthma is underdiagnosed in elderly people (Table 2) [21].

It is critical to make a diagnosis of asthma and to exclude other airway diseases (Table 3). Comorbid conditions together with a less typical clinical pattern have been shown to significantly affect misdiagnosis. Indeed, patients with an erroneous diagnosis of COPD have shown a lower Barthel index [19].

Table 1
Classification of asthma severity by clinical features [13].

Intermittent
Symptoms less than once a week
Brief exacerbations
Nocturnal symptoms not more than twice a month
FEV1 or PEF > 80% predicted
PEF or FEV1 variability < 20%
Mild Persistent
Symptoms more than once a week but less than once a day
Exacerbations may affect activity and sleep
Nocturnal symptoms more than twice a month
FEV1 or PEF > 80% predicted
PEF or FEV1 variability < 20%–30%
Moderate Persistent
Symptoms daily
Exacerbations may affect activity and sleep
Nocturnal symptoms more than once a week
FEV1 or PEF 60%–80% predicted
PEF or FEV1 variability > 30%
Severe Persistent
Symptoms daily
Frequent exacerbations
Frequent nocturnal asthma symptoms
FEV1 or PEF < 60% predicted
PEF or FEV1 variability > 30%

Table 2
Underdiagnosis of asthma [21].

Dyspnea is caused by aging
Reduction in perception of dyspnea
Self-limitation of activities

Social isolation
Depression
Misconception that adult-onset asthma is rare
Comorbid conditions

Table 3
Diseases that mimic asthma.
Chronic obstructive pulmonary Disease
Congestive heart failure
Bronchiectasis
Upper airway obstruction
Aspiration or inhaled foreign body
Hyperventilation/panic disorder
Churg-Strauss syndrome and other vasculitides

COPD is usually easy to distinguish from asthma but sometimes the distinction from late asthma in older patients, particularly in cigarette smokers, is difficult and may be impossible. Both diseases are characterized by the presence of airflow obstruction but have a distinct pathogenesis and require unique treatment approaches. In general, the degree of reversibility to a bronchodilator has been used to determine whether a patient has COPD or asthma. The fixed airflow limitation of most patients can be defined as a post bronchodilator FEV1 of < 80% pred (in the presence of a reduced FEV1/FVC) after a 7-to-14 day course of oral corticosteroids (40 mg per day for adults and 2 mg/kg per day in children) [23, 24]. A negative response may indicate COPD, or rarely refractory asthma (corticosteroid-resistant) [22, 25, 26].

The distinction between asthma and COPD basic simply on spirometric parameters is difficult; therefore there is a need for more discriminatory tests such as lung volume and the assessment of CO Diffusing capacity (DLCO). Lung volumes (TLC, FRC, RV, RV/TLC%) are elevated [27]. Moreover there is a significant difference in DLCO values between patients with COPD and asthma [28]. The decreased DLCO may be directly related to the loss of alveolar-capillary surface area that is associated with emphysema [27].

Other risk factors that may contribute to a poor response to conventional therapy must be excluding (Table 4) [22]. Some comorbid conditions may complicate asthma care. A recent study showed that sinusitis, heartburn, COPD, Congestive Heart Failure, and smoking are significantly higher in the over 65-year age group [29]. A number of medications used for comorbid conditions may worsen asthma (Table 5) [21]. ASA and NSAIDs are commonly prescribed in the elderly and may cause late-onset asthma. On other hand medication used for asthma worsens comorbid conditions (Table 6) [21]. Oral and typical β-adrenergic blocking agents [28] and other antiarrhythmic agents, including verapamil [30], and others with acknowledged β-blocker potential can exacerbate or cause asthma in those who are predisposed to the disease [14, 31].

Table 4
Risk factors [22].

Unidentified exacerbating factors
Unidentified allergens
Gastroesophageal reflux
Systemic diseases
Thyreotoxicosis
Carcinoid syndrome
Churg-Strauss syndrome and others vasculides
Drugs
β-blockers
Nonsteriodal anti-inflammatory drugs
Chronic infections
Mycoplasma
Chlamydia
Psycological factors

Table 5
Drugs that worsen asthma [21].

Hypertension	β blockers and ACE inhibitors
Glaucoma	Topical β blockers
Arthritis	Acetylsalicylic acid (ASA)/Non steroidal anti-inflammatory drugs (NSAIDs)

Table 6
Asthma drugs that worsen comorbid conditions [21].

β agonist	Arrhythmias
	Tremors
	Hypertension
	Hypokalemia
Theophylline	Gastroesophageal reflux
	Tremors
	Insomnia
Corticosteroids	Existing osteoporosis

The goals for successful management of asthma [13] are to

1. achieve and maintain control of symptoms,
2. prevent asthma exacerbations,
3. maintain pulmonary function as close to normal levels as possible,
4. maintain normal activity levels, including exercise,
5. avoid adverse effects from asthma medications,
6. prevent development of irreversible airflow limitation,
7. prevent asthma mortality.

Whenever possible, medications that might induce or aggravate asthma should be withdrawn. In other respects, the management of asthma in the elderly does not differ from that recommended for other age group, although particular care should be taken in the selection of and instruction in the use of inhaler devices [14]. Asthma drugs are preferably inhaled because this route minimizes systemic absorption and, thus, improves the ratio of the therapeutic benefit to the potential side-effects. Aerosolized medications that are used to treat asthma are available as pressurized metered-dose inhalers (MDIs), dry powder inhalers (DPIs), and nebulized or "wet" aerosol. Asthma medications should be used at the minimum dose and frequency required to maintain acceptable asthma control.

Medications used to treat asthma are generally divided into two main categories: relievers and controllers (Table 7). Relievers are best represented by the inhaled short-acting β2-agonist (SABA). Inhaled ipratropium bromide (IB) is less effective but is occasionally used as a reliever medication in patient intolerant of SABA. Controllers include anti-inflammatory medications, such as inhaled glucocorticosteroids (ICSs), leukotriene-receptor antagonists (LTRAs), long-acting inhaled β2-agonist (LABA), sodium cromoglycate, and sustained release theophylline [13–15]. Controller medications used daily on a long-term basis to achieve and maintain the goals of asthma treatment [13].

Table 7
Recommended medications by level of severity [13].

Level of severity	Daily controller medications	Other treatment options
Intermittent asthma	None necessary	
Mild persistent asthma	Low-dose ICS	Sustained-release theophylline LTRAs Sodium cromoglycate
Moderate persistent asthma	Low-to-medium dose ICS plus LABA	Sustained-release theophylline LTRAs Sodium cromoglycate
Severe persistent asthma	High-dose ICS plus LABA plus one or more of the following, if need Sustained-release theophylline	

Level of severity	Daily controller medications	Other treatment options
	LTRAs Oral CS	

ICSs are the most effective agents in this category. Several studies are demonstrated that treatment with ICS for 1 month or more significantly reduces the pathological signs of airway inflammation in asthma and airway hyperresponsiveness continues to improve with prolonged treatment. Local adverse effects from ICS include oropharyngeal candidiasis, disphonia, and occasional coughing from upper airways irritation. The use of a spacer (holding chamber) improves drug delivery from an MDI. Spacers also reduce ICS deposition in the mouth and oropharynx.

LABAs, including formoterol and salmeterol, are bronchodilator medications with activity persist for at least 12 hours. They should be considered when standard introductory doses of CSI fail to achieve control of asthma before raising the dose of ICS. The principal side effects are dose dependent and are mediated via receptors on vascular smooth muscle (tachycardia and tachyarrhythmia), skeletal muscle (tremor, hypokalemia due to potassium entry into muscle cells), and cells involved in lipid and carbohydrate metabolism (increase in blood free fatty acid, insulin, glucose, and pyruvate) [32].

LTRAs are a relatively new class of drugs for the treatment of asthma. There is a substantial body of evidence for their benefit in the management of chronic asthma in both adults and children, and particularly in specific types of asthma such as exercise-induced and aspirin-sensitive asthma.

Asthma is an important healthcare problem worldwide. Although the prevalence of asthma in older people is similar to younger people, this disease is underdiagnosed and undertreated. Asthma in the elderly patient adversely affects quality of life and results in a higher hospitalization rate and mortality. Despite international guidelines recommending appropriate therapy for asthma, they are, in elderly patient, often poorly managed The high incidence of

comorbid conditions makes the diagnosis and management more difficult. Despite the availability of effective antiasthma drugs, many old patients with asthma remain uncontrolled. Failure to achieve adequate control of asthma reveals a gap between what is known to be effective in asthma care and what might be achieved if optimal medication combined with management strategies could be implemented.

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Asthma in the elderly

SUMMARY OF PRACTICE POINTS	LEVEL OF EVIDENCE
Always attempt to make the distinction between asthma and COPD, or determine that both are present, so that the optimal treatment can be prescribed	[√]
Spirometry is mandatory for detecting airflow limitation in both asthma and COPD	[√]
The possibilities of both asthma and COPD must be considered in all patients with cough or unexplained breathing difficulty during physical activity	[√]
Demonstration of a small degree of acute reversibility to bronchodilators alone does not distinguish asthma from COPD.	[√]
Avoid the use of oral corticosteroids in treatment trials in elderly patients.	[√]
Warn patients that delay of effective treatment during an acute episode through over-reliance on nebulizers increases the risk of life-threatening asthma	[√]
Be aware that perception of airflow limitation is reduced in older people. Always ask "*Can you feel any difference after the reliever?*" before measuring post-bronchodilator FEV_1	[√]
Check inhaler technique and adherence whenever asthma is reviewed.	[√]
Set up an effective recall process to ensure annual influenza re-vaccination and review of pneumococcal vaccination status in all elderly patients with asthma, even in those with mild asthma.	[√]
Consider a PEF-based asthma action plan for patients who have shown poor perception of airflow limitation.	[√]

Asthma in elderly patients is more common than previously understood.[1-5]

- The lifetime asthma prevalence among middle-aged and older Australians is approximately 15%.[4,6] Asthma prevalence in the general adult population is estimated at approximately 10-12%.[7,8]
- Emerging international evidence suggests that the prevalences of both asthma and chronic obstructive pulmonary disease (COPD) are increasing.[9-11]

The risk of dying from asthma increases with age. The majority of asthma deaths occur in people aged 65 and over, particularly during the winter months.[7]

Asthma in the elderly is under-diagnosed

It has been estimated that up to one-third of elderly people with asthma are not identified by their doctors.[5,12]

- Lack of awareness of the possibility of new-onset asthma in the elderly may be a factor in both under-reporting and misdiagnosis.[13]
- Patients and doctors often attribute respiratory symptoms to ageing or common diseases of the elderly.[14,15]
- Elderly people may be unaware of reduced respiratory function when activities of daily living are limited by other conditions, or when perception of breathlessness is reduced.[16]
- Comorbidity may make the diagnosis of asthma in older people more difficult.

Identifying asthma in elderly patients is clinically important:

- Asthma tends to be more severe in older patients than younger adults, based on spirometric lung function parameters, clinical features of asthma (emergency visits and hospitalization rates) and comorbidities.[1,12,17- 21]
- Mortality rates are higher in elderly patients than in younger age groups, and acute asthma attacks more rapidly fatal.[22]
- Asthma is associated with significant disability, depression and impairment of mobility in older patients.[1,12,17,18]
- In the general population, long-term delay in the diagnosis of respiratory symptoms can lead to progressive and irreversible loss of pulmonary function,[23] while the benefits of prompt treatment are clear, even for mild asthma.[24-27]Similar benefits may be expected in the elderly.

Diagnosis of asthma in older patients

As for younger adults, the diagnosis of asthma in older patients is based on:

- history
- physical examination
- supportive diagnostic testing (e.g. spirometry).

For more information, see Diagnosis and classification of asthma in adults.

Diagnostic difficulties in the elderly are listed in Table 1. Despite these difficulties, always attempt to make the distinction between asthma and COPD, because they have different natural histories and expected response to therapy.[28]

There are many asthma phenotypes, and no single item or procedure can definitively determine the presence of asthma. Diagnosis involves an overall assessment of the patient's medical history, physical examination, laboratory test results and observation over time.

Spirometry is the most effective diagnostic tool available to assist general practitioners in the accurate diagnosis of asthma. Spirometry is mandatory for detecting airflow limitation in both asthma and COPD,[29,30] and helps distinguish between these diseases.

For more information, see COPD and asthma

Table 1. **Diagnostic difficulties in the elderly**

- Complex differential diagnosis - symptoms of asthma are non-specific and overlap with other conditions that are relatively common among older adults, including COPD, heart failure and lung cancer (e.g. it may be very difficult to distinguish between asthma and COPD in a smoker with a history of asthma)
- Poor recognition of symptoms - physiological changes of ageing can results in reduced perception of airflow limitation by patient.[16]
- Limited utility of direct tests of airway hyperresponsiveness - these are much less sensitive in people aged over 50 years than in younger adults.[31]
- Comorbidity - deafness, frailty, physical deconditioning and the presence of other chronic conditions (e.g. arthritis, heart disease) can contribute to problems in interpreting symptoms and performing lung function tests.
- Cognitive impairment may be a barrier to obtaining a clear and thorough history.
- Social isolation may delay presentation to medical services.

Suggested diagnostic steps in the elderly

A useful diagnostic approach in elderly patients with suspected respiratory disease is:

1. Aim to identify all patients with airflow limitation (either COPD or asthma)

2. Exclude other conditions

3. Distinguish COPD from asthma

4. Consider the possibility that asthma and COPD are both present and overlap.

A useful diagnostic approach in elderly patients with suspected respiratory disease is:

first: aim to identify all patients with airflow limitation (either COPD or asthma)

second: exclude other conditions

third: distinguish COPD from asthma and determine whether one or both are present.

Identifying patients with airflow limitation

Helpful questions to ask when taking a history in older adults with suspected airflow limitation (asthma, COPD or both) are listed in Table 2.

Consider symptoms, smoking history and allergies when taking the history.

Symptoms

The possibilities of asthma and COPD must both be considered in all patients with cough.

- In adults up to 75 years presenting with cough, around half may have asthma or COPD.[32,33]
- In patients aged 65 and over with new-onset asthma, the symptoms most frequently experienced are cough, wheeze and dyspnoea. Onset of symptoms commonly coincides with upper respiratory tract infection.[34]

Smoking history

Smoking history should be taken in all older patients with suspected respiratory disease. Smoking history is a major risk factor for COPD, but cannot rule out the diagnosis of asthma, especially in cases that overlap.

Allergy

History should include questions about history of allergy (hay fever, eczema).

- Atopy has been identified as an important predictor of asthma in the elderly as well as in other age groups[12,35,36]
- Ask about previous history of allergies and about seasonal response to environmental, household or animal allergens.[12]
- However, the absence of atopy or other immunological markers of asthma does not rule out an asthma diagnosis. Asthma may be triggered more often by respiratory tract viruses than allergies in older people.[34]

- Ask about family history as well as past history and of respiratory symptoms. Older people with current asthma symptoms commonly have a family history of asthma and childhood respiratory problems.[36]

For more information about allergic rhinitis, see Asthma and allergy.

Table 2. **Useful questions for identifying airflow limitation in older adults**

Diagnostic questions

- Have you had any wheezing or whistling in your chest in the last 12 months?
- Have you had this wheezing whistling when you did not have a cold?
- Have you woken at night with feeling of tightness in chest in the last 12 months?
- Have you been woken by an attack of shortness of breath in the last 12 months?
- Have you been woken by an attack of coughing in the last twelve months?
- Have you had an attack of asthma in the last 12 months?
- Are you currently taking any medicine for asthma?
- Do you have any nasal allergies including hay fever?

Risk factors

- Are you a smoker or ex-smoker?
- Did you have any allergies as a child?
- What type of work have you done for most of your life?

Excluding diagnoses other than asthma and COPD

A differential diagnosis for respiratory symptoms in older adults is set out in Table 3.

Where there in any uncertainty as to the cause of new symptoms, a chest X-ray should be done to rule out other significant morbidity or complications (eg pneumothorax) or other diagnoses (e.g. congestive heart failure or lung carcinoma).[35,37,38]

Table 3. **Important causes for respiratory symptoms in the elderly**

Pulmonary	• Asthma • Chronic obstructive pulmonary disease • Bronchiectasis • Pulmonary emboli • Pulmonary fibrosis • Pneumonia, bronchitis • Pleural effusion • Pneumothorax • Malignant disease

	• Aspiration pneumonitis
Cardiac	• Arrhythmias • Ischaemic heart disease • Valvular heart disease • Cardiomyopathies • Pericardial disease
Neurological	• Respiratory muscle weakness • Motor neurone disease • Myasthenia gravis
Drug-related	• Oral and topical beta$_2$ adrenergic receptor antagonists • Nonsteroidal anti-inflammatory drugs • Angiotensin converting enzyme (ACE) inhibitors
Other	• Vocal cord dysfunction • Gastroesophageal reflux disease • Anemia • Anxiety • Tracheal stenosis

Distinguishing asthma from COPD

Practice points

- Always attempt to make the distinction between asthma and COPD, or determine that both are present, so that the optimal treatment can be prescribed. [√]
- Spirometry is mandatory for detecting airflow limitation in both asthma and COPD. [√]
- The possibilities of both asthma and COPD must be considered in all patients with cough or unexplained breathing difficulty during physical activity. [√]
- Demonstration of a small degree of acute reversibility to bronchodilators alone does not distinguish asthma from COPD. [√]

Asthma in the elderly is often difficult to distinguish from COPD. Clinical signs of asthma and COPD overlap. Discriminating between asthma and COPD (Table 4), or concluding that both diseases are present and overlapping, is based on the following:

- symptom information
- degree of reversibility of airflow limitation
- peak expiratory flow (PEF) variability
- bronchial hyperresponsiveness
- history of allergy.

Note that:

- single symptoms do not discriminate between asthma and COPD.[39]
- maximal relevant diagnostic information is obtained when spirometry is performed before and after bronchodilator **and** before and after a treatment trial.
- the diagnosis might be made with confidence only after observing and collecting clinical data for weeks or months.

For more information, see COPD and asthma.

Table 4. **Factors that distinguish asthma from COPD**

	Factor Present In	
	Asthma	**COPD**
Young age at onset	Often	Almost never
Sudden onset of disease	Often	Almost never
Smoking history	Sometimes	Almost always
Allergy	Often	Sometimes
Dyspnoea	Often	Often
Wheezing	Often	Sometimes
Coughing	Sometimes	Often
Sputum production	Seldom	Often
Chronic airflow limitation	Seldom	Almost always
Variable airflow limitation	Almost always	Seldom
Reversible airflow limitation	Almost always	Almost never
Airway hyperresponsiveness	Almost always	Sometimes
Diurnal peak expiratory flow variability	Almost always	Sometimes

Adapted from Van Schayck C, 1996[40]

These factors can help distinguish between asthma and COPD, but be aware that both conditions may be present.

Spirometry in the elderly

As in younger adults, spirometry findings must be interpreted carefully, with reference to clinical findings. Clinicians should be aware of potential pitfalls in the interpretation of spirometry in the elderly, listed in Table 5.

- The diagnosis of asthma can be made with a high degree of confidence when post-bronchodilator FEV_1/FVC ratio is greater than 70% and acute reversibility is demonstrated after administration of bronchodilator (a postbronchodilator increase of ≥200 ml and ≥ 12% in FEV_1 or FVC).
- The diagnosis of probable asthma can be made by demonstrating acute reversibility after bronchodilator, even when post-bronchodilator FEV_1/FVC ratio is less than 70%.
- Reversibility of airflow limitation after a therapeutic trial helps confirm the diagnosis of asthma.

For more information on criteria for reversibility of airflow limitation, see Diagnosis and classification of asthma in adults.

COPD

- Spirometry is mandatory for the detection of early stages of COPD in general practice, and at least doubles the proportion of patients identified.[30]
- The diagnosis of COPD is based on a demonstration of airflow limitation (post-bronchodilator FEV_1/FVC ratio of less than 70%), together with lack of acute reversibility after administration of bronchodilator. This criterion may result in false positives in older people,[41] but that is preferable to under-diagnosis, given the potential poor health outcomes in older people.
- Lack of full reversibility after a therapeutic trial helps confirm the diagnosis.

See COPD and asthma.

Overlap of asthma and COPD

The presence of overlapping COPD and asthma is a strong possibility in a patient whose clinical profile includes all of the following features:

- Age over 45 years
- A history of smoking
- Reversibility of airflow limitation acutely after bronchodilator or over time
- Post-bronchodilator FEV_1/ FVC <70%.

Table 5. **Spirometry pitfalls in the elderly**

Spirometry does not rule out asthma	• Spirometry (especially post-bronchodilator readings) may be normal in people with asthma. • Among older people with respiratory symptoms, spirometry is a sensitive tool for finding COPD cases, but is less sensitive for identifying those with asthma.

Acute reversibility of airflow limitation alone does not rule out COPD	• Demonstration of a small degree of acute reversibility to bronchodilators does not, on its own, distinguish asthma from COPD.[42] • Reversibility of airflow limitation can be demonstrated in people with COPD who do not have a concurrent diagnosis of asthma.[43,44] • Measuring bronchodilator response on different occasions may result in differing results for reversibility.[45,46] • Response may differ according to the medication (e.g. salbutamol vs. oral corticosteroids), or reversibility criteria used.[47]

The role of a diagnostic treatment trial in the elderly

A treatment trial attempting to reduce airflow limitation and symptoms can provide valuable diagnostic information.

- An appropriate trial regimen for most patients is ICS given at a dose of 500-1000 mcg fluticasone or 800-1600 mcg budesonide (or equivalent). For safety reasons, ICS is preferable to a short trial of oral corticosteroids.
- For most patients, 4-8 weeks is an appropriate length for a treatment trial.[48]
- The delivery device should be selected individually, based on ease of use and cost.
    - Dry powder inhalers may be easier for older patients to use.
    - When a metered dose inhaler (MDI) is chosen, a spacer should be used.

The response should be monitored according to asthma control, symptoms and spirometry. For more information on monitoring asthma control, see Ongoing care.

Managing asthma in elderly patients

Drug treatment

As for patients of all age groups:

- the choice of initial treatment is guided by the severity of untreated asthma at the time of diagnosis

- subsequent modifications of the treatment regimen will depend on the degree of symptom control achieved at regular ongoing review.
- the diagnosis should be reconsidered in a patient whose symptoms respond poorly to therapy.[49]

Factors affecting the choice of delivery device in older patients

Comorbidities in older patients will influence the choice of delivery devices:

- Patients who are frail, weak, or have arthritis affecting the hands may need to use additional aids or undergo a trial of various devices to determine the optimal delivery method
- Patients with cognitive disorders may require a care giver to help them use MDIs and spacers
- Delivery of drugs by nebulizer may be necessary in some patients.

Prescribing issues

When prescribing asthma medications for elderly patients, choose doses cautiously and monitor closely for adverse effects. Clinical trials conducted for registration purposes have generally included few elderly patients.

Consider these issues and consult the Approved Product Information as necessary:

- When prescribing oral corticosteroids, consider the possibility of reactivation of tuberculosis and monitor closely, particularly in those born in countries with high prevalences.
- Lower initial doses (compared with general adult doses) are recommended for some drugs (e.g. salbutamol).
- Clearance of some drugs (e.g. theophylline) is decreased in the elderly and in those with impaired liver function.
- Consider potential interactions with other drugs, e.g.:
    - The risk of hypokalaemia is increased by the concomitant use of beta$_2$ agonists and diuretics
    - Theophylline and aminophylline interact with a range of agents. If these are used, start with a low dose and monitor closely for drug-drug interactions.
- Elderly patients with multiple comorbidities may experience difficulties taking complex medication regimens correctly. A Home Medicines Review may be useful. For more information, see The role of the community pharmacist.

Asthma and diabetes

The early use of high-dose inhaled corticosteroids in response to potential exacerbations might be considered in patients with diabetes, in order to avoid the use of oral corticosteroids.

Patients with diabetes need to understand how to control hyperglycaemia, should it be necessary to initiate a short course of oral prednisolone during an asthma exacerbation.

Patient education

As for other age groups, offer patients and carers self-management education, and not only information. This education should be aim to help them integrate previous ideas and beliefs about asthma with current knowledge. For more information, see Provide self-management education.

- Cognitive status, dexterity and eyesight must be taken into account when educating patients about the roles and correct use of medicines, and use of inhalation devices (Table 6).
- Ensure that patients and care givers are given clear information on when to call emergency services. Inappropriate reliance on nebulizers may delay effective treatment.

Practice points

- Avoid the use of oral corticosteroids in treatment trials in elderly patients. [√]
- Warn patients that delay of effective treatment during an acute episode through over-reliance on nebulizers increases the risk of life-threatening asthma. [√]
- Be aware that perception of airflow limitation is reduced in older people. Always ask "*Can you feel any difference after the reliever?*" before measuring post-bronchodilator FEV_1. [√]
- Check inhaler technique and adherence whenever asthma is reviewed. [√]

Table 6. **Patient-related factors to consider when choosing a delivery system**

Aspects to consider	**Delivery system notes**
• Strength to operate the device • Inspiratory flow rate • Coordination • Agility	• MDI versus breath-activated devices • Spacers
Visual acuity and ability to judge fill status	• Dose counters require good eyesight
Strength and function of hands	• *Haleraids* for patients with arthritis or disability

• Cognitive status • Understanding of the roles of each medication	• Where possible, don't mix inhaler types within a treatment regimen • Reinforce when each medication should be taken • Reinforce role of nebulizers

Review of asthma in the elderly patient

Practice points

- Set up an effective recall process to ensure annual influenza re-vaccination and review of pneumococcal vaccination status in all elderly patients with asthma, even in those with mild asthma. [√]
- Consider a PEF-based asthma action plan for patients who have shown poor perception of airflow limitation. [√]

The principles of asthma review in the elderly patient are the same as for other age-groups with asthma. The appropriate frequency of review depends on severity e.g, weekly review may be appropriate in a patient with a recent life-threatening asthma attack; review every 6 or 12 months may be suitable for someone with stable mild persistent asthma.

- Ask whether the patient has experienced any problems with asthma, medication or monitoring.
- Ask about night waking with asthma, morning symptoms, asthma-related limit of normal activity, shortness of breath, wheeze and short-acting beta$_2$ agonist (SABA) use. For questionnaires available for use in monitoring asthma, see Ongoing care.
- Ask whether there have been any changes in the use of medications.
- Ask about adherence to the treatment plan.
- Ask about any changes in the environment.
- Ask whether there are any aggravating factors (e.g. gastric reflux).
- Ask whether the person took his or her reliever bronchodilator medication.
- Perform spirometry before and after bronchodilator, and check perception of post-bronchodilator effect.
- Check device technique.
- Check the patient's (and/or care giver's) understanding of the asthma action plan by asking *"What would you do if ...?"*.

Factors that commonly complicate the monitoring of asthma control in older people include:

- reduced perception of airflow limitation
- comorbidities (e.g. poor eyesight, hearing impairment, weakness due to osteoarthritis, cognitive deficits, neurological deficits secondary to cerebrovascular disease)
- psychosocial issues (e.g. lack of care giver, dependence, lack of confidence, depression, perceived and actual financial barriers, resistance to accepting the diagnosis, low motivation).

Consider these strategies to overcome common difficulties:

- For patients with impaired grip strength, add a device to a standard inhaler to make actuation easier (e.g. *Haleraid*).
- Put a large, easily visible marker on the PEF meter to make it easier for a person with poor eyesight to judge PEF relative to best recorded value (compared with reading from the scale)
- For patients who cannot perform PEF monitoring (e.g. due to stroke or dementia), teach a care giver to observe for signs that indicate increased respiratory work:
    - inability to speak in sentences of more than a few words between breaths
    - respiratory distress or marked anxiety
    - acute cognitive impairment compared with usual status.

Perception of airflow limitation

Assessment of the patient's ability to perceive changes in airway function is an important part of the assessment of older patients, both when initiating treatment and at each subsequent review.

Perception of airway function can be assessed in two ways:

1. Asking about the use of SABAs

An elderly patient who gives a history of using SABAs in response to asthma symptoms probably has reasonably good perception of airflow limitation.

2. Checking whether the person is aware of a change in symptoms or ease of breathing when a large post-bronchodilator response in FEV_1 (or PEF) is measured.

- Routinely ask "*Can you feel any difference after the reliever?*" before measuring post-bronchodilator FEV_1. If other staff (e.g. practice nurses) are performing spirometry, train them to include this question with all older patients.
- If the patient has not perceived any change despite a large response (e.g. an increase in FEV_1 of > 20% and > 400 mLs), it is advisable to write a PEF-based asthma action plan.

Practice tip

Schedule a consultation specifically to assess asthma if possible, because:

- It is difficult to check all these aspects of asthma at one review
- Asthma control can only be assessed when exacerbations are absent.

Vaccination

Check the status of influenza and pneumococcal vaccination every year in February-March. Ensure that an effective recall process is in place to ensure annual influenza re-vaccination in all elderly patients with asthma - even in those with mild asthma - and that initial pneumococcal vaccination and subsequent revaccination occurs in line with NHMRC recommendations.

Acute exacerbations and action plans in elderly patients

Comorbidity must be considered when planning management of asthma exacerbations in the elderly.

- Where feasible, a PEF-based asthma action plan should be considered for patients who have shown poor perception of airflow limitation.
- A large-print (or handwritten) action plan, or an audiotape of the action plan may benefit visually impaired patients.
- Patients whose first language is not English may need an audiotape of the action plan in their native language.

Asthma Glossary of Terms

Allergen: a substance (such as a food or pollen) that your body perceives as dangerous and can cause an allergic reaction.

Allergy: an exaggerated response to a substance or condition produced by the release of histamine or histamine-like substances in affected cells.

Alveoli: thin-walled, small sacs located at the ends of the smallest airways in the lungs where the exchange of oxygen and carbon dioxide takes place.

Antibiotic: medication used to treat infection caused by bacteria. Antibiotics do not protect against viruses and do not prevent the common cold.

Anticholinergics: (also called cholinergic blockers or "maintenance" bronchodilators). This type of medicine relaxes the muscle bands that tighten around the airways. This action opens the

airways, letting more air out of the lungs to improve breathing. Anticholinergics also help clear mucus from the lungs.

Antihistamine: medication that stops the action of histamine, which causes symptoms of allergy such as itching and swelling.

Anti-inflammatory: medication that reduces inflammation (swelling in the airway and mucus production).

Asthma: a disease of the airways or branches of the lung (bronchial tubes) that carry air in and out of the lungs. Asthma causes the airways to narrow, the lining of the airways to swell and the cells that line the airways to produce more mucus. These changes make breathing difficult and cause a feeling of not getting enough air into the lungs. Common symptoms include cough, shortness of breath, wheezing, chest tightness, and excess mucus production.

Bacteria: infectious organisms that may cause sinusitis, bronchitis, or pneumonia.

Beta$_2$-agonists: a bronchodilator medication that opens the airways of the lung by relaxing the muscles around the airways that have tightened (bronchospasm). These medications may be short acting (quick relief) or long acting (control) medications. Short acting beta2 agonists are the drugs used to relieve asthma symptoms when they occur.

Breath sounds: lung sounds heard through a stethoscope.

Breathing rate: the number of breaths per minute.

Bronchial tubes: airways in the lung that branch from the trachea (windpipe).

Bronchioles: the smallest branches of the airways in the lungs. They connect to the alveoli (air sacs).

Bronchodilator: a drug that relaxes the muscle bands that tighten around the airways. Bronchodilators also help clear mucus from the lungs.

Bronchospasm: the tightening of the muscle bands that surround the airways, causing the airways to narrow.

Carbon dioxide: a colorless, odorless gas that is formed in the tissues and is delivered to the lungs to be exhaled.

Chronic disease: a disease that can be controlled, but not cured.

Cilia: hair-like structures that line the airways in the lungs and help to clean out the airways.

Clinical trials: research programs conducted with patients to evaluate a new medical treatment, drug, or device. The purpose of clinical trials is to find new and improved methods of treating different diseases and special conditions.

Contraindication: a reason not to use a course of treatment or medication.

Dander, animal: tiny scales shed from animal skin or hair. Dander floats in the air, settles on surfaces and is a major part of household dust. Cat dander is a classic cause of allergic reactions.

Decongestant: medication that shrinks swollen nasal tissues to relieve symptoms of nasal swelling, congestion, and mucus secretion.

Dehydration: excessive loss of water.

Diaphragm: the major muscle of breathing, located at the base of the lungs.

Dry powder inhaler (DPI): a device for inhaling respiratory medications that come in powder form.

Dust mites: a common trigger for allergies.

Dyspnea: shortness of breath.

Exacerbation: worsening.

Exercise induced asthma**:** asthma that is made worse when exercising

Exhalation: breathing air out of the lungs

(HEPA) high-efficiency particulate air filter: a filter that removes particles in the air by forcing it through screens containing microscopic pores.

Histamine: a naturally occurring substance that is released by the immune system after being exposed to an allergen. When you inhale an allergen, mast cells located in the nose and lungs release histamine. Histamine then attaches to receptors on nearby blood vessels, causing them to enlarge (dilate). Histamine also binds to other receptors located in nasal tissues, causing redness, swelling, itching, and changes in the secretions.

Holding chamber: see spacer.

Humidification: the act of moisturizing the air with molecules of water.

Hyperventilation: excessive rate and depth of breathing.

Immune system: the body's defense system that protects us against infections and foreign substances.

Indication: reason to use.

Inflammation: a response in the body includes swelling and redness.

Inhaler: See metered dose inhaler (MDI).

Inhalation: breathing air into the lungs.

Irritants: things that bother the nose, throat, or airways when they are inhaled (not an allergen).

Leukotriene modifier: drug that blocks chemicals called leukotrienes in the airways. Leukotrienes occur naturally in the body and cause tightening of airway muscles and production of excess mucus and fluid. Leukotriene modifiers work by blocking leukotrienes and decreasing these reactions. These medications are also helpful in improving airflow and reducing some symptoms chronic obstructive pulmonary disease (COPD).

Medical history: a list of a person's previous illnesses, present conditions, symptoms, medications, and health risk factors.

Metered dose inhaler (MDI): small aerosol canister in a plastic container that releases a mist of medication when pressed down from the top. This drug can be breathed into the airways. Many asthma medications are taken using an MDI.

Mold: parasitic, microscopic fungi (like Penicillin) with spores that float in the air like pollen. Mold is a common trigger for allergies and can be found in damp areas, such as the basement or bathroom, as well as in the outdoor environment in grass, leaf piles, hay, mulch, or under mushrooms.

Monitoring: keeping track of.

Mucus: a material produced by glands in the airways, nose, and sinuses. Mucus cleans and protects certain parts of the body such as the lungs.

Nasal spray: medication used to prevent and treat nasal allergy symptoms. Available by prescription or over-the-counter in decongestant, corticosteroid, or salt-water solution form.

Nebulizer: a machine that changes liquid medicine into fine droplets (in aerosol or mist form) that are inhaled through a mouthpiece or mask. Nebulizers can be used to deliver bronchodilator (airway-opening) drugs such as albuterol and Atrovent, as well as anti-inflammatory medicines (Pulmicort Respules). A nebulizer may be used instead of a metered dose inhaler (MDI). It is powered by a compressed air machine and plugs into an electrical outlet.

Non-steroidal: anti-inflammatory medication that is not a steroid. Also see steroid.

Oxygen: the essential element in the respiration process to sustain life. This colorless, odorless gas makes up about 21% of the air.

Peak Expiratory flow rate: a test used to measure how fast air can be exhaled from the lungs.

Peak flow meter: a small hand-held device that measures how fast air comes out of the lungs when a person exhales forcefully. This measurement is called a peak expiratory flow (PEF) and is measured in liters per minute (lpm). A person's PEF may drop hours or even days before asthma symptoms are noticeable. Readings from the meter can help the patient recognize early changes that may be signs of worsening asthma. A peak flow meter can also help the patient learn what triggers his or her symptoms and understand what symptoms indicate that emergency care is needed. Peak flow readings also help the doctor decide when to stop or add medications.

Personal best peak expiratory flow (PEF): the highest peak flow number a person can achieve when symptoms are under good control. The personal best PEF is the number to which all other peak flow readings will be compared. In children, peak expiratory flow rates are based on how tall the child is. Therefore, the personal best peak expiratory flow will change as growth occurs. A child's personal best peak expiratory flow should be redetermined approximately every 6 months or when a growth spurt has occurred.

Pneumonia: an infection of the lung, which may be located in only one area.

Pollen: a fine, powdery substance released by plants and trees; an allergen.

Pollen and mold counts: a measure of the amount of allergens in the air. The counts are usually reported for mold spores and three types of pollen: grasses, trees, and weeds. The count is reported as grains per cubic meter of air and is translated into a corresponding level: absent, low, medium, or high.

Productive cough: a "wet" cough that may involve coughing up mucus.

Puffer: another term for inhaler or metered dose inhaler.

Pulmonary function tests (PFTS): a test or series of tests that measure many aspects of lung function and capacity; also referred to as lung function tests.

Pulse oximetry: a test in which a device that clips on the finger measures the oxygen level in the blood.

Respiration: the process of breathing which includes the exchange of gases in the blood (oxygen and carbon dioxide), the taking in and processing of oxygen, and the delivery of carbon dioxide to the lungs for removal. See inhalation and exhalation.

Sinuses: air pockets inside the head.

Spacer: a chamber that is used with a metered dose inhaler to help the medication get into the airways better. Spacers also make metered dose inhalers easier to use; spacers are sometimes called "holding chambers."

Spirometry: a basic pulmonary function test that measures how much and how fast air moves out of the lungs.

Sputum: mucus or phlegm.

Steroid: medication that reduces swelling and inflammation. Comes in pill, injected, and inhaled forms. Also called corticosteroid.

Symptom: what someone will experience as a result of a disease or illness, like pain, cough, or shortness of breath, for example.

Theophylline: a long- term control medication that opens the airways, which prevents and relieves bronchospasm.

Trachea: the main airway (windpipe) supplying both lungs.

Triggers: things that cause asthma symptoms to begin or make them worse.

Vaccine: a shot that protects the body from a specific disease by stimulating the body's own immune system.

Wheezing: the high-pitched whistling sound of air moving through narrowed airways.

Asthma in the Elderly Examination

Select the ***best*** answer to each of the following items. Mark your responses on the Answer form.

1. Asthma is a common disease in the general population, with an overall prevalence in the US in 2002 of _____% reported by the National Center for Health Statistics.

a. 3
b. 7
c. 12
d. 17

2. There is a common misperception that asthma is predominantly a childhood disease. However, in a survey of elderly persons from four communities in the US, the prevalence of physician-diagnosed asthma was 4%, with another 4% having probable asthma (symptoms of asthma without a diagnosis). This is similar to other estimates that 7–9% of individuals over the age of 70 have asthma.

a. True
b. False

3. Unfortunately, the diagnosis of asthma is frequently overlooked in the geriatric population. Some elderly patients are reluctant to admit their symptoms, or consider them a result of normal aging. Under-reporting of symptoms in the elderly may have many causes, including _____, denial, and blaming of symptoms on other comorbid illnesses.

a. depression
b. cognitive impairment
c. social isolation
d. All of the above

4. The diagnosis of asthma is frequently confused with chronic obstructive pulmonary disease (COPD), a disease usually, but not always, associated with cigarette smoking. Both are associated with symptoms of shortness of breath, wheezing, cough, sputum production, and airflow obstruction on pulmonary function testing. In one study of a group of elderly asthmatic patients (mean age of 73 years), only 53% of patients had been correctly identified as having asthma. Furthermore, _____% of patients were given the wrong diagnosis of COPD.

a. 12
b. 19.5
c. 22
d. None of the above

5. Fixed Airflow Obstruction in Elderly Asthmatics: In addition to bronchoconstriction, causes of airflow obstruction are _____, airway smooth muscle hypertrophy, and subepithelial fibrosis. All of these architectural changes are collectively referred to as 'airway remodeling.'

a. mucous plugging
b. bronchial wall edema
c. inflammatory cell infiltration
d. All of the above

6. In one random survey of 1,200 elderly asthmatics over the age of 65 years, only one in _____ patients had normal pulmonary function (FEV_1 >80% predicted), while a similar number showed moderate to severe airflow obstruction (FEV_1 <50% predicted) after an inhaled short-acting bronchodilator. Since structural changes of emphysema are minimal in elderly asthmatics, airway remodeling is thought to be the main cause of fixed airflow obstruction.

a. three
b. five
c. ten
d. twenty

7. The medications used to treat the elderly asthmatic are the same as those used to treat younger patients. Inhaled short-acting $beta_2$ adrenergic agonists are the treatment of choice for the acute exacerbation of asthma symptoms. They can be delivered by metered-dose inhaler (MDI) and compressor-driven nebulizers.

a. True
b. False

8. Longitudinal studies of asthmatic populations have shown that remission from asthma is uncommon in older age groups, occurring in about 20% of patients. Elderly asthmatics with _____, or a concomitant diagnosis of COPD are much less likely to have a remission.

a. severe symptoms
b. long-standing disease
c. reduced pulmonary function
d. All of the above

9. Elderly asthmatic patients mainly include subjects who acquired the disease during childhood or adolescence and whose disease progressed over time or relapsed after periods of remission (Elderly asthmatic, long duration); however, the first manifestations of asthma may also occur in the late adulthood or after 65 years of age (elderly asthmatic, late onset).

a. True
b. False

10. Little is known about the natural history of asthma in elderly patients, but there is evidence in literature that _____, have a lower quality of life, and experiences greater morbidity and mortality.

a. the elderly asthmatic patient is underdiagnosed
b. they are undertreated
c. they have a higher risk of hospitalization
d. All of the above

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