

In this issue we introduce a new feature called, "Evidence-Based Clinical Vignettes." This clinical article format represents a new link between the Care Management Institute (CMI), the National CME Committee, and The Permanente Journal (TPJ). CMI develops interregional evidence-based best practice guidelines, the National CME Committee provides CME credit for clinical education, and TPJ is a forum for the widest dissemination of Permanente Medicine. Dr David Price, who is both a member of the National CME Committee and a CMI clinical guideline leader, will be the Feature Editor. It is through his work that we have this first article and new series.



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Evidence-Based Clinical Vignettes from the Care Management Institute: Asthma

Introduction

More than 17 million Americans—young and old alike—have asthma,¹ a condition that is both common and expensive: In 1998, direct medical costs for asthma treatment exceeded \$11 billion.¹ Despite availability of effective therapy for controlling asthma, its incidence is increasing;² nonetheless, *asthma continues to be underdiagnosed and undertreated*. Appropriate management of asthma requires:

- correct diagnosis;
- assessment of severity;
- proper management, including appropriate medication, patient education, and a written action plan;
- ongoing monitoring;
- appropriate follow-up; and
- specialty referral where appropriate.^{2,3}

This article, the first in a series highlighting key aspects of guidelines and care programs from the Care Management Institute (CMI), is a brief overview of the recently revised physician guidelines for asthma care.

Case Example

A 32-year-old female smoker presents with a seven-day history of "bronchitis." She states that she experiences a harsh, rattling, nonproductive cough with chest tightness three to four times each year. She requests a prescription for guaifenesin with codeine and either erythromycin or azithromycin, which was prescribed for her in the past and which usually takes effect after about seven to ten days. She is afebrile and has had scant clear nasal discharge for the past three days. She has no chest pain, tightness, or heaviness.

Physical examination shows that she has a harsh-sounding, paroxysmal cough without nasal flaring, cyanosis, or retractions. Her respiratory rate is 16 breaths/minute, and pulse oximetry shows 96% saturation on room air. Pulmonary examination shows slight expiratory wheezing and occasional bibasilar rhonchi that clear with coughing. Results of cardiac examination are normal, and no ankle edema is present.

What is the patient's diagnosis? What additional history would be helpful? What additional testing would you perform? How severe is her condition? How do you explain the diagnosis to her? What is the appropriate treatment? What information does the patient need to help prevent recurrence? What is the appropriate follow-up?

Definition of Asthma

Kaiser Permanente's *CMI Asthma Guidelines*² defines asthma:

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role (in particular mast cells, eosinophils, T-lymphocytes, neutrophils, and epithelial cells). In susceptible individuals, the inflammation causes recurrent symptoms of breathlessness, wheezing, chest tightness, and cough. There is usually widespread airflow obstruction with these episodic symptoms which is reversible to varying degrees either spontaneously, or with treatment. The inflammation appears to be linked to an increase in airway hyperresponsiveness to a variety of stimuli.^{2,8}

Table 1. Differential diagnosis of asthma

Congestive heart failure
Chronic obstructive pulmonary disease (COPD)
Cystic fibrosis
Drug reactions (eg, angiotensin-converting enzyme (ACE) inhibitor)
Foreign body aspiration
Hypersensitivity pneumonitis
Hyperventilation syndrome
Ischemic heart disease
Occupational lung disease
Panic attacks
Pneumonia
Pneumothorax
Postviral cough
Pulmonary emboli
Restrictive lung disease
Upper airway obstruction
Vocal cord dysfunction
Vasculitis

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Diagnostic Procedure

The same *Guidelines* advise:

To establish the diagnosis of asthma, the clinician must determine that:

- episodic symptoms of airflow obstruction are present;
- airflow obstruction is at least partially reversible;
- alternative diagnoses are excluded.^{2,8-9}

The diagnosis is usually derived from the patient's medical history and results of physical examina-



tion. However, certain cases necessitate further diagnostic evaluation, including spirometry, bronchial inhalation challenge tests, blood and sputum studies, chest x-ray examination, or a combination of these procedures.³

Performing spirometry before and after use of a bronchodilator is essential for diagnosis and ongoing monitoring of asthma.^{2,4-6} Often underutilized, spirometry is a reliable way to confirm presence, variability, and reversibility of airflow obstruction as well as to measure change in airflow obstruction as changes are made in therapy and as changes occur in the patient's condition over time. Spirometry is also useful to help exclude other diagnoses frequently confused with asthma (Table 1).³ Asthma is diagnosed when spirometry shows a clinically significant response to bronchodilator use (>15%), frequently with normalization of val-

For patients who comply with recommended therapy, poor response to treatment should also raise suspicion as to the correct diagnosis.

ues. In the patient above, spirometry would be useful to differentiate asthma from bronchitis, a disease with either fixed or no airflow obstruction. A methacholine challenge test may be useful in patients who have normal spirometry results despite symptoms suggesting asthma.

Comorbid conditions such as sinusitis, allergy, gastroesophageal reflux disease (GERD), and hypothyroidism may worsen asthma. A smoking history of more than 20 pack-years, even in a patient who has clearly had asthma in the past, should raise suspicion of chronic obstructive pulmonary disease (COPD). Dyspnea alone or

exertional chest pain should suggest another diagnosis than asthma—in particular, a diagnosis of cardiac or thromboembolic disease. For patients who comply with recommended therapy, poor response to treatment should also raise suspicion as to the correct diagnosis. Stridor (squeaky sounds over the larynx, especially on inspiration) should suggest vocal cord dysfunction.

Assessment of Asthma Severity

All asthmatic patients should be categorized as having either *intermittent or persistent asthma*.³ Persistent asthma can be further classified as mild, moderate, or severe (Table 2),³ although treatment is more strongly related to response to medication than to initial severity of disease. The classification system presented in Table 2 should be based on the patient's status before treatment; the classification

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	Symptoms	Nighttime symptoms	Lung function
Mild, intermittent	<ul style="list-style-type: none"> • Symptoms ≤2 times per week • Asymptomatic and normal PEF between exacerbations • Exacerbations brief (from a few hours to a few days); intensity may vary 	≤2 times per month	<ul style="list-style-type: none"> • FEV₁ or PEF ≥80% predicted • PEF variability <20%
Mild, persistent	<ul style="list-style-type: none"> • Symptoms >2 times per week but <1 time per day • Exacerbations may affect activity 	>2 times per month	<ul style="list-style-type: none"> • FEV₁ or PEF >80% predicted • PEF variability 20-30%
Moderate, persistent	<ul style="list-style-type: none"> • Daily symptoms • Daily use of inhaled short-acting beta-2-agonist • Exacerbations affect activity • Exacerbations ≥2 times per week; may last days 	>1 time per week	<ul style="list-style-type: none"> • FEV₁ or PEF >60%<80% predicted • PEF variability >30%
Severe, persistent	<ul style="list-style-type: none"> • Continual symptoms • Limited physical activity • Frequent exacerbations 	Frequent	<ul style="list-style-type: none"> • FEV₁ or PEF <60% predicted • PEF variability >30%

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system is more difficult to use in asthmatic patients already receiving treatment. For that reason, the classification system is appropriately used as a guide. Presence of any symptom in a higher classification places the patient at that higher level. Patients often underreport their nighttime symptoms, so these symptoms must be specifically sought out by clinicians.

Patients are at *high risk* for hospitalization, emergency department visits, and unscheduled medical care if they meet any of the following criteria:⁷

- hospitalization for asthma within the prior 12 months;
- baseline forced expiratory volume in one second (FEV₁), forced vital capacity (FVC), or FEV₁/FVC <60% of predicted value;
- four or more canisters of short-acting beta-agonists dispensed in 12 months and any use of a systemic corticosteroid agent in the same 12-month period;
- 12 or more canisters of short-acting beta-agonists (or six or more prescriptions for these drugs) dispensed in a 12-month period.

Experience in the KP Northern California, Southern California, Northwest, and Hawaii Regions has shown that aggressive intervention in this group of asthmatic patients can improve clinical outcome and reduce cost.

Asthma Control

Goals of asthma management are listed in Table 3.²

Management

Asthma management includes both drug therapy and patient education^{2,3} and should also include a written action plan.⁸

Drug Therapy

For all asthmatic patients, short-acting beta-agonists, such as albuterol, should be available as “rescue medication.” A metered-dose inhaler (MDI) is the most convenient and effective way to deliver albuterol. MDIs are preferred over air-powered nebulizers for ambulatory patients, including those seen in the emergency department as long as they do not potentially need intubation. Use of MDIs is more cost-effective than use of nebulizers, and MDIs use a much lower dose of medication to achieve results equal to those of nebulizers. Short-acting beta-agonists should be used only as needed. Regular dosing—except before exercise in those with exercise-induced bronchospasm—should be avoided. Someone who can teach this skill and who has experience observing patients using MDIs should instruct the patient in proper MDI technique. Experts recommend reviewing MDI technique with patients at least yearly. *Use of one or more canisters a month should be recognized as a marker of poor asthma control.*^{2,3}

The *cornerstone of drug therapy*

The cornerstone of drug therapy is use of inhaled corticosteroids.

is use of inhaled corticosteroids.^{2,4}

These “controller medications” can be given either by MDI or by dry powder inhaler (DPI). Newer MDIs deliver corticosteroid agents to the bronchial tree more effectively and use newer chemical propellants that are less harmful to the environment.⁹ All patients other than those with solely exercise-induced or mild, intermittent asthma need controller medication. Patients with moderate or severe persistent asthma should preferably use inhaled corticosteroid agents. Patients with mild, persistent asthma may respond well to cromolyn or nedocromil, but many of this subset of asthmatic patients will need inhaled corticosteroid agents. Patients should use the least amount that leads to absence of nocturnal cough and that eliminates the need for rescue medication or reduction in physical activity due to asthma. Most asthma experts recommend that patients begin therapy at a moderate or high dosage to gain

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Table 3. Goals of asthma management

• Prevent chronic, troublesome symptoms
• Maintain pulmonary function as closely as possible to normal or personal best
• Maintain normal activity levels (including exercise and other physical activity)
• Prevent recurrent exacerbations of asthma and minimize need for emergency visits or hospitalization
• Provide optimal pharmacotherapy with minimal or no adverse effects
• Meet patients' and families' expectations of and satisfaction with asthma care

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control of symptoms, then taper to the lowest dosage needed to maintain asthma control.

Patients with moderate or severe persistent asthma should have oral prednisone available for emergencies.

Other Asthma Medications

In patients using inhaled corticosteroids with breakthrough symptoms after four weeks of therapy, a long-acting beta-agonist, salmeterol (two puffs twice daily or two puffs only at bedtime if the only breakthrough symptoms are nocturnal), is added to the inhaled corticosteroid agent. This approach is more effective than increasing the steroid dosage (an alternative approach).¹⁰

Leukotriene antagonists and theophylline have limited roles in treating asthma. In general, these medications are reserved for patients in whom asthma cannot be controlled by high dosages of inhaled corticosteroid agents and salmeterol. When these medications are used, their effect should be carefully measured to reduce both cost and potential toxicity. Specialty consultation should be strongly considered for patients who need these medications.²

Education

Smoking cessation is especially crucial for asthmatic patients. Smoking increases risk for development of emphysema in asthmatic patients and *reduces efficacy of controller medications*.¹¹

All patients with persistent asthma should have a *written asthma action plan*.^{2,3,8,9} This plan should list signs and symptoms of worsening asthma and should recommend changes patients can make on their own to address moderate as well as severe exac-

Table 4. Criteria for specialty consultation for patients with asthma
• Life-threatening asthma exacerbation
• Goals of asthma therapy not met despite three to six months of treatment
• Lack of response to therapy
• Atypical signs and symptoms
• Unclear diagnosis
• Diagnosis or treatment of asthma complicated by comorbid conditions (eg, sinusitis, nasal polyps, aspergillosis, severe rhinitis, vocal cord dysfunction, gastroesophageal reflux, chronic obstructive pulmonary disease)
• Additional diagnostic testing indicated (eg, allergy skin testing, rhinoscopy, complete pulmonary function studies, provocative challenge, bronchoscopy)
• Additional patient education on complications of therapy, problems with adherence, or allergen avoidance
• Possible need for immunotherapy
• Severe, persistent asthma requiring high-dosage therapy with inhaled corticosteroid agents for a prolonged period
• Continuous oral corticosteroid therapy or high-dosage therapy with inhaled corticosteroid agents
• More than two bursts of oral corticosteroid usage in one year

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erbations. Examples of written asthma action plans are available from several sources.^{3,4}

Monitoring

As in many chronic diseases, patients may not fully comply with their treatment plans.¹² The clinician should be alert to *signs of non-compliance*, such as an increasing number of requests to refill prescriptions for beta-agonists; poor asthma control; and hospitalization or need for urgent medical care. Clinicians who detect noncompliance should work with the patient in a nonjudgmental way to help improve compliance.

All patients with asthma should actively monitor their condition. Monitoring can be based on symptoms or on peak flow measurement. A peak flow-based plan may be more effective for patients

who reliably measure peak flow daily. Patients monitoring peak flow should be instructed when and how to initiate and adjust their medication and when to visit their physicians or the emergency department.

Follow-up Care

All patients with asthma need regular monitoring by their medical practitioners.² Although studies have not determined the optimum frequency of this follow-up care, CMI and other expert panels have concluded that *annual visits* are appropriate for patients with well-controlled asthma and that more frequent visits are needed for patients with uncontrolled asthma. Follow-up care should be given within a week after an emergency department visit or hospitalization.

Smoking cessation is especially crucial for asthmatic patients. Smoking increases risk for development of emphysema in asthmatic patients and reduces efficacy of controller medications.

A history of nocturnal cough (even between exacerbations), other milder episodes of asthma, and history of allergy, rhinitis, and exposure to substances that precipitate these conditions would lend support to the diagnosis of asthma.

Specialty referral

Specialty referral should be considered for any asthmatic patient who meets the criteria listed in Table 4.³

Case Example: Treatment Approach

For the patient described earlier, the correct diagnosis is probably either chronic bronchitis or asthma. At 32 years of age, the patient is somewhat more likely to have asthma. Her medical history suggests episodic disease that resolves within a couple of weeks, but the clinician should seek confirmation of this diagnosis by seeking additional information about the patient's medical history. A history of nocturnal cough (even between exacerbations), other milder episodes of asthma, and history of allergy, rhinitis, and exposure to substances that precipitate these conditions would lend support to the diagnosis of asthma. Spirometry would be a very important test for confirming the presence of airflow obstruction and properly assessing asthma severity in this patient. A history of ongoing and nocturnal symptoms also would be used to establish asthma severity.

Once a diagnosis of asthma is established and severity is estimated, the patient will need additional information explaining

- the chronic nature of this disease;
- the importance of asthma control;
- the importance of ongoing monitoring, possibly including peak flow monitoring;
- the need to identify and control exacerbating factors such as dust mites, animal fur and dander, and exposure to pollen; and

- the importance of regular follow-up visits with a single primary care physician.

The patient also needs to receive a firm message relaying the critical importance of smoking cessation to improve medication effectiveness, prevent recurrence, and decrease risk for emphysema. Appropriate support should be given in these smoking cessation efforts. If allergies seem to be a major contributor to asthma, referral for allergy testing should be considered.

For persistent asthma, the patient will need several years of treatment (or lifelong treatment) with a controller medication, the choice of which depends on disease severity. If an inhaled form of corticosteroid agent is given, the patient will need to use a spacer device in addition to rescue medication, typically albuterol, for use only as needed. Demonstration of proper MDI technique and reassessment of technique at the first follow-up visit are critical. The patient will benefit from following a written asthma action plan. This plan may be simple for intermittent asthma but more detailed for persistent asthma, especially if moderate or severe.

The patient must understand the importance of avoiding or eliminating exposure to substances that

precipitate asthma flare-ups, and compliance with the treatment plan should be emphasized. Initial follow-up should occur after no more than four to six weeks.

Conclusion

Asthma is an important chronic disease resulting in clinically significant morbidity, missed days of work or school, substantial costs for emergency care and hospitalization, and, sometimes, death. Current therapy can control asthma and may prevent development of irreversible airway changes in asthmatic patients. Key points for diagnosis and treatment of asthma are summarized in Practice Tips.

CMI has recently completed an extensive, evidence-based revision of the adult asthma guideline² that provides up-to-date, useful information on asthma diagnosis, prognosis, and treatment. The guidelines also summarize current best practice and present detailed information about a wide variety of issues, including acute care, alternative types of therapy, and ineffective types of therapy. The guidelines include sections for special situations such as exercise-induced asthma and pregnancy. The full

Practice Tips

- Asthma should be strongly suspected in any patient with recurrent or persisting cough or wheezing.
- Spirometry should be used to diagnose and categorize asthma.
- Patients with persistent asthma require controller medications, usually inhaled corticosteroid agents.
- All asthmatic patients who smoke should be strongly encouraged to quit.
- Asthmatic patients should have patient education, including a written action plan.
- Asthmatic patients should receive regular follow-up care.
- Specialty consultation should be considered for all patients with complicated asthma.



document is available on the Permanente Knowledge Connection Web site: http://pkc.kp.org/IAC_Guidelines.pdf. ❖

Acknowledgment

We acknowledge the CMI Asthma Guideline Development Group and the CMI Asthma Advisory Group.

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Brain Breathes Mind

Brain breathes mind
like lungs breathe air.

Forgotten Truth, *Huston Smith, PhD*