The asthmatic patient and sedation

Introduction

The sedation practitioner is often faced with difficult questions to answer before the administration of sedation. Our guidelines say clearly that we are only allowed to treat ASA 1 and 2 patients outside the operating theater. It is our responsibility to see that we meet these criteria.

In this article we are faced with the problem of an asthmatic patient. How are we going to prepare this patient before sedation? How do we know whether we can treat this patient safely under sedation outside the hospital setting?

Patients with respiratory disease, like asthmatic patients, have an increased risk of respiratory complications e.g. bronchospasm during sedation. Modification of disease severity and patient optimization prior to sedation is vital to prevent possible complications.

Asthma is one of the most common chronic diseases, with an estimated 300 million individuals affected worldwide and the prevalence is on the increase.

Asthma has puzzled and confused physicians from the time of Hippocrates to the present day. The word “asthma” comes from a Greek word meaning “panting”, but reference to asthma can also be found in ancient Egyptian, Hebrew and Indian medical writings. There are clear observations of patients experiencing attacks of asthma in the 2nd century, and evidence of disordered anatomy in the lung as far back as the 17th century.

Definition

Asthma is a disease characterized by chronic airway inflammation, reversible expiratory airflow obstruction in response to various stimuli, and bronchial hyper-reactivity.

Bronchial asthma can occur at any age but usually appears early in life. Approximately half of the cases develop before ten years of age, and another third occur before the age 40.

Signs and symptoms

Asthma is an episodic disease with acute exacerbations followed by symptom free periods. Most attacks last from minutes to hours, clinically the patient seems to recover completely after an attack. However, there can be a phase
in which the patient experiences some degree of airway obstruction daily. This phase can be mild, with or without superimposed severe episodes, or much more serious, with significant obstruction persisting for day or weeks.

Clinical manifestations of asthma include wheezing, productive or nonproductive cough, dyspnea, chest discomfort or tightness that may lead to "air hunger".

The following illustration shows the symptoms and signs that an asthmatic patient may have. With this information the sedation practitioner will be able to make a differential diagnosis, and decide whether the patient is fit for treatment under sedation.

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**Is it Asthma?**

*Presence of any of these signs and symptoms should increase suspicion of asthma:*

- Wheezing: high-pitched whistling sounds when breathing out

- History of any of the following:
  - Cough, worse at night
  - Recurrent wheeze
  - Recurrent difficult breathing
  - Recurrent chest tightness

- Symptoms occur or worse at night, awakening the patient.

- Symptoms occur or worsen in a seasonal pattern.

- The patient also has eczema, hay fever or a family history of asthma or atopic diseases.

- Symptoms occur or worsen in the presence of:
  - Animals with fur
  - Aerosol chemicals
  - Changes in temperature
  - Domestic dust mites
  - Drugs (aspirin, beta blockers)
  - Exercise
  - Pollen
  - Respiratory (viral) infections
  - Smoke
  - Strong emotional expression
Diagnosis

Spirometry is the preferred method of measuring airflow limitation and its reversibility to establish a diagnosis of asthma. However, every sedation practitioner may not have this and may have to rely on clinical symptoms and signs.

An increase in the FEV₁ (forced expiratory volume in one second) of > 12% and > 200ml after administration of a bronchodilator indicates reversible airflow limitation consistent with asthma.

FEV₁ and maximum mid-expiratory flow rate are direct measures of the severity of expiratory airflow obstruction. These measurements provide objective data that can be used to assess the severity and monitor the course of an exacerbation of asthma.

The typical patient who come to a hospital for treatment has a FEV₁ of less than 35% of normal and a maximum mid-expiratory flow rate 20% or less of normal.

During moderate to severe asthmatic attacks, the functional residual capacity (FRC) may increase substantially but total lung capacity for carbon monoxide is not changed. Bronchodilator responsiveness can provide supporting evidence when asthma is suspected on clinical grounds. In patients with expiratory airflow obstruction, an increase in airflow after inhalation of a bronchodilator suggests asthma. Abnormalities in pulmonary function tests may persist for several days after an acute asthmatic attack despite the absence of symptoms.

Since asthma is an episodic illness, its diagnosis may be suspected on clinical grounds even when pulmonary function tests are normal.

Patients with mild asthma (the sort of cases that we usually consider for sedation outside the operating theater) usually have a normal PaO₂ (oxygen) and PaCO₂ (carbon dioxide).
Diagnostic Challenges

Cough variant asthma

Some patients with asthma have a chronic cough (frequently occurring at night) as their only symptom.

Exercise-induced bronchoconstriction

Physical activity is an important cause of asthma symptoms for most asthma patients, and for some (including many children) it is the only cause. Exercise testing with a 8 minute running protocol can establish a firm diagnosis of asthma.

Children five years and younger

Not all young children who wheeze have asthma. In this age group, the diagnosis of asthma must be based largely on clinical judgment, and should be regularly reviewed as the child grows older.

Asthma and the elderly

Diagnosis and treatment of asthma in the elderly are complicated by poor perception of symptoms, acceptance of dyspnea as being “normal” for old age, and reduced expectations of mobility and activity.

Occupational asthma

Asthma acquired in the workplace is a diagnosis that is frequently missed. The diagnosis requires a defined history of occupational exposure to sensitizing agents, an absence of asthma symptoms before beginning employment, and a documented relationship between symptoms and the work place (Improvement in symptoms away from work and worsening of symptoms upon return to work).
COPD (Chronic obstructive pulmonary disease)

Both asthma and COPD are syndromes of airflow limitation, but with significant differences. COPD patients are usually found in smokers or ex-smokers.

Patients with COPD rarely develop symptoms before the age of 40. Difficult breathing is persistent, progressive, and worsens with exertion. Night-time attacks of difficult breathing are uncommon, and day-to-day variability of symptoms is rare.

A high proportion of asthma patients are non-smokers. Symptom onset before the age of 40 is common. Variability of symptoms is usual, and patients may be asymptomatic between attacks.

Differences have also been noted in the pulmonary inflammation caused by asthma and COPD in terms of cells, mediators and the anatomic sites of the disease. These differences support the hypothesis that asthma and COPD are distinct diseases with different underlying mechanisms.

However, distinguishing asthma from COPD can be difficult. In reality, there is substantial overlap between them. Patients with asthma who smoke or have been exposed to air pollution may have non-reversible airflow limitation. Likewise, a substantial proportion of patients who meet the definition of COPD have reversible airflow limitation with a positive bronchodilator test, both criteria of asthma. It has been suggested that asthma and COPD are different manifestations of the same underlying disease.

Common Asthma Triggers

Many people with asthma have allergies, which can trigger asthma symptoms. Common allergens include house dust mites, animal dander, molds, pollen and cockroach droppings. Tobacco smoke is an irritant that often aggravates asthma. Attacks of asthma may be triggered by air pollution, strong odors, or fumes. Patients with asthma can develop asthma symptoms when exercising. The attacks typically follow exertion, usually not during it. This is called exercise-induced bronchoconstriction.

Drugs can cause or even worsen asthma symptoms. Drugs include aspirin or other non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen, and beta-blockers. Some asthma patients can take certain NSAIDs without getting an asthma attack. Ask the patient about this before starting sedation.
Emotional anxiety and stress may also cause asthma symptoms and trigger an attack. Viral and bacterial infections such as a common cold and sinusitis may also trigger an attack. In some patients an attack follows exposure to cold, dry air or weather changes. Acid reflux, with or without heartburn is also a known trigger.

### Differential Diagnoses

- Airway Foreign Body
- Allergic and Environmental Asthma
- Alpha1-Antitrypsin Deficiency
- Bronchiectasis
- Bronchiolitis
- Chronic Obstructive Pulmonary Disease (COPD)
- Cystic Fibrosis
- Epiglottitis or Croup
- Foreign Body Aspiration
- Gastro-esophageal Reflux Disease (GER)
- Heart Failure
- Pulmonary Edema
- Pulmonary Embolism
- Pulmonary Eosinophilia
- Rheumatoid arthritis with bronchiolitis
- Sinusitis
- Upper Respiratory Tract Infection
- Vocal Cord Dysfunction
- Viral Tracheo-bronchitis

### Common Asthma Triggers

- Allergens
- Exercise
- Drugs
- Anxiety, stress
- Infections
- Acid Reflux
- Occupational irritants
- Tobacco and cigarette smoke
Treatment

It is extremely important for the sedation practitioner to be aware of, and know the drugs patients are taking for treatment of asthma. We cannot use drugs that will cause bronchoconstriction, or interact with the drugs.

Historically, treatment of asthma has been directed at preventing and controlling bronchospasm with bronchodilator drugs. Recognition of the consistent presence of airway inflammation in patients with asthma has resulted in a change in pharmacologic therapy. The emphasis now is on preventing and controlling bronchial inflammation. Bronchodilator therapy does not influence inflammatory changes in the airways and could mask underlying inflammation by relieving symptoms and allowing continued exposure to allergens.

Asthma treatment has two components. The first is the use of “controller” treatments, which modify the airway environment such that acute airway narrowing occurs less frequently. “Controller treatments” include inhaled and systemic corticosteroids, theophylline, and antileukotrienes. The other component of asthma treatment is the use of “reliever” or rescue agents for acute bronchospasm. Reliever treatments include β-adrenergic agonists and anticholinergic drugs.

Future treatment

According to findings from pilot studies an unique inhaled drug, RPL554, was effective and well-tolerated as a bronchodilator, bronchoprotector, and anti-inflammatory drug in patients with COPD or asthma. RPL554 is a dual inhibitor agent blocking the activity of two phospho-diesterase enzymes: PDE3 and PDE4.

Pharmacologic Agents Used in the Treatment of Asthma

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Actions</th>
<th>Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-inflammatory drugs</td>
<td>Corticosteroids: beclomethasone, triamcinolone, flunisolide, fluticasone, budesonide</td>
<td>Decrease airway inflammation, reduce airway hyperresponsiveness</td>
<td>Dysphonia, myopathy of laryngeal muscles, oropharyngeal candidiasis</td>
</tr>
<tr>
<td>Category</td>
<td>Drug</td>
<td>Effect</td>
<td>Side Effect</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Leukotriene</td>
<td>Cromolyn</td>
<td>Inhibit mediator release from mast cells, membrane stabilization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leukotriene modifiers: zafirlukast (Accolate), pranlukast (Ultair), montelukast (Singulair), zileuton (Zyflo)</td>
<td>Reduce synthesis of leukotrienes by inhibiting 5-lipoxygenase enzyme</td>
<td>Increased hepatic enzyme levels</td>
</tr>
<tr>
<td>Bronchodilators</td>
<td>β-adrenergic agonists: albuterol, metaproterenol, salmeterol</td>
<td>Stimulate β2-receptors of tracheobronchial tree</td>
<td>Tachycardia, tremors, dysrhythmias, hypokalemia</td>
</tr>
<tr>
<td></td>
<td>Anticholinergics: ipratropium, atropine, glycopyrrolate</td>
<td>Decrease vagal tone by blocking muscarinic receptors in airway smooth muscle</td>
<td></td>
</tr>
<tr>
<td>Methylxanthines</td>
<td>Theophylline</td>
<td>Increase cAMP by inhibiting phosphodiesterase, block adenosine receptors, release endogenous catecholamines</td>
<td>Disrupted sleep cycle, nervousness, nausea, vomiting, anorexia, headache, dysrhythmias</td>
</tr>
</tbody>
</table>

cAMP = cyclic adenosine monophosphate.

**Pre-sedation assessment**

Pre-sedation evaluation of patients with asthma requires an assessment of disease severity (clinical evaluation), the effectiveness of current pharmacologic management, and the need for additional therapy prior to sedation/surgery/procedure.

The sedation practitioner must assess whether the patient can be classified as an ASA 1 or 2 patient as only those patients qualify for sedation outside the hospital setting.
The Global Initiative for Asthma (GINA) published criteria for the successful management of asthma. The Union follows these same criteria closely in its own guidelines.

- No symptoms or very mild symptoms
- No attacks
- No emergency department visits
- No limitation of activities
- No airflow limitation (PEF ≥ 80% of predicted value)
- Minimal bronchodilator use (< 2 times/week)
- Least side effects as possible

Many studies suggest that asthmatics be assessed one week before surgery/procedure/sedation to optimize treatment plans and plan for the sedation procedure.

Because preventative treatment with oral steroids is not indicated in all asthmatics, a history and physical examination (especially presence of wheezing), and often spirometry (if available) is necessary before sedation.

Preoperative evaluation begins with a clinical history to evaluate the severity and characteristics of the patient's asthma. In the case of children the mothers are usually very helpful to tell the sedation practitioner whether asthma is under control or not.

On physical examination, the general appearance of the patient and the use of the accessory muscles of respiration e.g. abdominal muscles should be assessed. Auscultation of the chest to detect wheezing or abnormal lung sounds are important. Airway hyperreactivity provides an indirect assessment of the current status of the disease.

### Characteristics of Asthma

**To Be Evaluated Preoperatively**

- Age at Onset
- Triggering Events
- Hospitalization for Asthma
- Frequency of Emergency Department Visits
- Need For Intubation and Mechanical Ventilation
- Allergies
- Cough
- Sputum Characteristics
- Current Medications
- Anesthetic History
An increase in the use of bronchodilators, recent exacerbations, or frequent hospital visits are important risk factors for bronchospasm during sedation. Some of the most useful aspects of clinical information are listed in the table below. Important elements include the number of times per week the patient requires a short-acting beta agonist, whether the patient has/had an upper respiratory tract infection or flare of chronic sinusitis that may have triggered symptoms.

In case of use of oral steroids, how often oral steroids have been used and for what duration, the last time the patient required oral steroids, and the dose required, and whether the patient currently uses inhaled steroids or has used them in the past.

Several sources suggest that pulmonary function tests or spirometry before the sedation/procedure is a useful component of pulmonary assessment in patients with asthma and/or COPD. This is unfortunately not always available.

If the patient’s symptoms are severe, the sedation/procedure must be postponed until the precipitating factor is treated e.g. a chronic sinus infection or community acquired pneumonia. If there is any concern regarding lung pathology, a chest radiograph should be obtained before sedation.

Another potential trigger of asthma symptoms is gastro-esophageal reflux (GERD); 77% of patients with asthma have GERD, which may or may not be symptomatic. Control of GERD in adults and children often results in a significant improvement of asthma symptoms. Treatment of GERD may include lifestyle changes and medication such as a H2 antagonist or a proton pump inhibitor (PPI) 8.

### Asthma control and current therapy

1. Increased use of inhaled short-acting beta agonists? Use per week?
2. Current or past use of inhaled corticosteroids?
3. Recent asthma exacerbation? Did this require ER or hospital visit?
4. Most recent course of oral corticosteroids?

### Asthma history and complicating conditions or factors

1. Recent upper respiratory tract infection or sinus infection?
2. Recent pneumonia? Was this documented on chest radiograph?
3. History of intubation or ICU admission for asthma?
4. History of pulmonary complications with prior surgical procedures?
5. History of long-term corticosteroid use or corticosteroid-dependent asthma?
Levels of asthma control

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Controlled</th>
<th>Partly controlled</th>
<th>Uncontrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime symptoms</td>
<td>None (twice or less a week)</td>
<td>More than twice a week</td>
<td></td>
</tr>
<tr>
<td>Limitation of activities</td>
<td>None</td>
<td>Any</td>
<td>Three or more features of partly controlled asthma</td>
</tr>
<tr>
<td>Nocturnal symptoms/awakening</td>
<td>None</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>Need for reliever/rescue</td>
<td>None</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>inhaler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lung function</td>
<td>Normal</td>
<td>&lt;80% predicted or personal best if known</td>
<td></td>
</tr>
</tbody>
</table>

Pre-sedation Therapy

The goals are to reverse inflammation and bronchospasm and to reduce the likelihood of bronchospasm during or after sedation. Corticosteroids such as prednisone have been shown to improve lung function within hours of administration. The question is are those patients then still ASA 2 patients.

If the patient has no symptoms before sedation (especially wheezing), does not require any asthma medications, and has not had any asthmatic attack during the past year, then preventative treatment with oral or inhaled steroids is not necessary. They qualify for sedation outside the operating theatre.

If the patient is on bronchodilators only and has no history of oral corticosteroid use, then the patient should be treated with the inhaled bronchodilator he/she is usually for one week before sedation.

I ask all my patients to bring the inhaler to the surgery when sedation is planned. I ask the patient to take a “puff” of the aerosol bronchodilator drug immediately before sedation. Asthmatic patients are usually anxious patients. When they have their inhaler with them when coming for sedation they usually feel more comfortable and less anxious.

If the patient is on oral steroids chronically, then the dose should be increased for 5 days before sedation. Patients who are already on inhaled steroids or oral steroids should also receive hydrocortisone 100 mg intravenously the morning before sedation.
Whenever patients are taking oral steroids it should be considered whether that patient is not an ASA 3 classification. This means sedation cannot be done in the surgery.

The use of anticholinergic drugs should be individualized, remembering that these drugs can increase the viscosity of airway secretions, making them more difficult to remove from the airway. If an anticholinergic drug is used atropine seems to be a better choice than glycopyrrolate. Anti-inflammatory and bronchodilator therapy should be continued until the time of sedation. Patients should be free of wheezing and have a peak expiratory flow greater than 80% of predicted or at the level of the patient's personal best value prior to sedation.

### Guidelines for preventative pharmacotherapy

<table>
<thead>
<tr>
<th>Clinical characteristics of asthma</th>
<th>Corresponding preoperative pharmacologic therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No asthma symptoms</strong>&lt;br&gt;Not on any asthma medications&lt;br&gt;No flares in asthma symptoms over past year&lt;br&gt;Spirometry does not show significant obstruction</td>
<td>No additional asthma therapy preoperatively</td>
</tr>
<tr>
<td><strong>On bronchodilators only</strong>&lt;br&gt;No history of oral corticosteroid use&lt;br&gt;Spirometry is not below baseline</td>
<td>Initiate therapy with inhaled corticosteroid, beclomethasone 400 μg per day or equivalent dose, one week before surgery</td>
</tr>
<tr>
<td><strong>If spirometry is below baseline or patient is having flare of symptoms</strong></td>
<td>Consider adding prednisone 0.5 mg/kg for 5 days before surgery</td>
</tr>
<tr>
<td><strong>Already on inhaled corticosteroid</strong></td>
<td>Continue treatment with inhaled corticosteroid</td>
</tr>
<tr>
<td><strong>Spirometry at or below baseline</strong></td>
<td>Treat with prednisone 0.5 mg/kg for 5 days before surgery&lt;br&gt;Treat with hydrocortisone 100 mg IV the morning before surgery and postoperatively until stable</td>
</tr>
<tr>
<td><strong>Patient is already on oral steroids</strong></td>
<td>Increase dose of oral steroids for 5 days before surgery&lt;br&gt;Treat with hydrocortisone 100 mg IV the morning before surgery and postoperatively until stable</td>
</tr>
</tbody>
</table>
Patient education

Patient education should be done by the patient’s own general practitioner. Every consultation is an opportunity to improve the patient’s health through education. Try and help the patients identify risk factors. Work on a strategy to avoid these factors. This is called “My asthma action plan”\(^\text{12}\). Evaluate the patient’s inhaler technique. Ask the patient to explain their treatment to you. Does the patient understand the difference between “controller” and “reliever” medication? Ask the patient to demonstrate their inhaler technique. Get the patient involved in monitoring their symptoms using an asthma diary called “My asthma diary form”\(^\text{12}\).

In today’s modern age, there is a range of applications (Apps) available to download, from the basic asthma diary to a modified peak flow meter using the microphone of your smart phone.

Open communication with the patient is imperative. A scheduled evaluation consultation is very important. This provides an excellent opportunity to discuss the possible risks and complications that may arise during sedation of an asthmatic patient and to re-assure them. It helps the patient to make an informed decision to proceed with the sedation or not. If the patient understands the importance of adequate control of asthma before sedation, it will help motivate the patient to adhere to current and additional treatment. It is important that the patient is also honest regarding their symptoms on the day of scheduled sedation. At the end of the consultation the patient must feel comfortable to reschedule the planned procedure/sedation if there is a flare up of symptoms (especially wheezing) on the day of sedation.

Reasons not to do the case

- Recent or current upper or lower respiratory tract infection
- Uncontrolled asthma (Do not do sedation in an outpatient environment)
- Poor clinical control
- Frequent exacerbations in the past year
- Previous admission to critical care for asthma
- Low FEV\(_1\)
- High dose medications
- Other co-morbidities (ASA III to IV)
- Current exacerbation
Some useful tips for your patient

During the month before the operation, ensure your asthma is as well controlled as possible through optimal use of medication.

Avoid exposure to trigger factors.

Smoking and inhaling other people’s cigarette smoke are common trigger factors.

Bring your inhalers with you on the day of sedation / procedure.

How do you know whether asthma is well controlled

The Asthma Control test™ will provide you with a snapshot of how well your asthma has been controlled over the last four weeks, giving you a simple score out of 25. Asthma symptoms can vary from month to month, so it is worth keeping the test handy to see if your score changes. You can also share your results with your doctor or asthma nurse to help explain just how your asthma affects you. Your asthma may not have been controlled during the past four weeks. Your doctor or nurse can recommend an asthma action plan to help improve your asthma control.

What does your score mean?

**Score: 25 – Well Done**

Your asthma appears to have been under control over the past four weeks
However, if you are experiencing any problems with your asthma, you should see your doctor or nurse.

**SCORE: 20 TO 24 – ON TARGET**

Your asthma appears to have been reasonably well controlled during the past four weeks. However, if you are experiencing symptoms your doctor or nurse may be able to help you.

**SCORE: LESS THAN 20 – OFF TARGET**

Your asthma may not have been controlled during the past four weeks. Your doctor or nurse can recommend an asthma action plan to help improve your asthma control.

**How do you know if your asthma is well managed?**

<table>
<thead>
<tr>
<th>Take the 30 Second Asthma Test®:</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you cough, wheeze, or have a tight chest because of your asthma? (4 or more days a week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does coughing, wheezing, or chest tightness wake you at night? (1 or more times a week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you stop exercising because of your asthma? (In the past 3 months)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you ever miss work or school because of your asthma? (In the past 3 months)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you use your rescue medication (blue puffer) 4 or more times a week? (Except 1 dose per day for exercise)</td>
<td></td>
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</tr>
</tbody>
</table>

If you answer YES to one or more questions, talk to your doctor or certified asthma educator about how you can better manage your asthma.

*The 30 Second Asthma Test® is a registered trademark, used under license by GlaxoSmithKline Inc.*
References


