

# Asthma in Adults

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Asthma, or acute reversible obstructive airways disease (ROAD), is a major respiratory disease affecting approximately eight million people in the United States. The disease is characterized by attacks of wheezing dyspnea with coughing and sputum production. Although most adult patients who have the disease demonstrate either bronchospastic episodes during childhood or will have repeated episodes of respiratory infection, upper and lower or both during early years, some patients do begin only in later life, that is, adult onset asthma. All of these patients usually have no symptoms or signs during interval periods, but with proper stimuli will demonstrate airways obstruction.

The pathogenesis and pathology of asthma are located in the airways where there is bronchospasm from contraction of the circumairway smooth muscle, mucosal edema, and excessive mucous production, all leading to narrowing of the airway lumen. These processes are initiated by the release of chemical mediators from pulmonary mast cells by a variety of stimuli. The abnormal response of the asthmatic bronchus may be caused by an immune reaction involving IgE, by infection, by certain physical factors including exercise and cold temperature, as well as by a combination of these factors and probably other unknown factors. Patients with asthma respond to minimal stimuli with increase in airways resistance indicating the presence of increased airway tone or ease of provocation—"twitchy airways." This is indicated by the smaller dose of known airway

constrictors necessary to produce bronchoconstriction in an asthmatic than in a normal person. This has led to the theory of partial beta blockade. The sympathetic beta two receptors located in the airways are bronchodilating. Inhibition or blockade of these receptors results in bronchoconstriction, thus suggesting a partial beta blockade in patients with asthma. Alpha sympathetic stimulation also leads to bronchoconstriction. This knowledge has led to the better understanding of the biochemical mechanisms of asthma and to drug therapy. Superficially, bronchodilation is medicated primarily by increases in 3, 5 cyclic AMP. Cyclic AMP production is increased by beta agonists, for example, ephedrine, isoproterenol, isoetharine, and others. Its breakdown is inhibited by methylxanthines, for example, aminophylline. Therefore, it is very rational to treat asthmatics with both of these classes of drugs at the same time (1-4).

The diagnosis of ROAD is not difficult in the usual case. However, particularly in older adults, difficulty in separating other chronic airways disease, especially chronic bronchitis, becomes a problem. These two conditions frequently occur together and should be separated, according to the purist. From a practical therapeutic standpoint, it makes little difference, except from a prognostic standpoint, since chronic bronchitis tends to be a progressive disease and asthma may not be.

The management of ROAD can be separated into three phases: 1) Outpatient, 2) Emergency Room, and 3) Inpatient. The objective of therapy should be to avoid, if at all possible, phases two and three.

Outpatient management should include a diligent search for inciting causes of episodes,

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particularly those avoidable irritants which must be isolated and removed from the patient's environment. This must include a thorough history to evaluate the problems of allergy, for example, previous history of allergic reactions, eczema as a child, recurring rhinitis, hayfever, and other factors. On physical examination, the presence of congested, bluish, nasal mucous membranes or nasal polyps suggests allergy. Eosinophilia in nasal or sputum smears or peripheral blood smears, additionally, suggests allergy and should be evaluated in all patients with ROAD. Since many parasitic diseases will have pulmonary involvement, the stools of patients with peripheral eosinophilia should be evaluated for ova and parasites. Most people spend more time in their bedroom than in any other room, thus attempts should be made to keep this room as dust- and antigen-free as possible. Therefore, nonallergic bed covers and pillows should be used, overstuffed furniture, wool rugs, and draperies should be removed. The room should be cleaned in the morning to allow dust to settle before night. No animals should be allowed in the bedroom. I believe that all patients who have a suggestion of allergy should be evaluated by an allergist and desensitized if indicated.

The drug therapy of ROAD should include both sympathomimetics, (epinephrine, ephedrine, terbutaline, metaproterenol, and others) plus xanthines (aminophylline) for the above mentioned reasons. Depending upon the severity of the difficulty, the dosage of these drugs will need to be varied. Some patients will require drugs intermittently, some continuously. Since much of the problem is caused by excessive mucous plugging of airways (7), and antihistamines have a drying effect on mucous, tending to make its removal more difficult, I prefer not to use these drugs. Instead, these patients should be encouraged to force hydrate themselves to keep secretions in as loose a state as possible. The use of antibiotics is predicated on the presence of infection which is best assessed by evaluation of the sputum, both in wet preparation and gram stains, to look for polys and pathogenic bacteria as well as eosinophils, Charcot-Leyden crystals, and Curschmann's spirals. Adrenal steroids should be used as the last drug when other drugs have failed or in patients who have been known to require steroids previously. Another drug which has outpatient application is cromolyn sodium. This drug has no effect in the acute attack and should be used only to prevent attacks. It should be tried in patients who have frequent bronchospastic

episodes or who require continuous steroids to avoid attacks. It must be administered four times daily and should be given for several weeks to assess its therapeutic value. The combination of the above modalities should be adequate to control 80% to 90% of all patients with ROAD.

Most patients who arrive in the Emergency Room because the above regimen has failed or because they have not had proper medical supervision will respond to parenteral bronchodilators. However, arterial blood gases should be measured to evaluate the need for oxygen therapy. Eighty percent or more of these patients will have mild hypoxemia and will be hyperventilating, (low  $\text{PaCO}_2$ ) (5). If the  $\text{pCO}_2$  is normal or elevated, this indicates a more severe state and such an individual should be considered under phase three (6). Either subcutaneous epinephrine 0.3 cc, 1:1000 aqueous epinephrine or terbutaline 0.25 mg should be given initially and may be repeated in 15 to 30 minutes if needed. Obviously, patients with cardiac disease (arrhythmia, angina, hypertension, and others) are at great risk under these conditions, particularly if very hypoxemic, and must be monitored carefully. If this is ineffective, intravenous aminophylline should be used, 5 to 6 mg/kg body weight, no more rapidly than 50 mg/min (10).

Aerosolized sympathomimetics may be used also, or instead of parenteral drug. Again, the cardiac rate, rhythm, and blood pressure must be monitored since there is a significant systemic effect from most of these drugs.

Most of these patients will be quite anxious and the temptation to sedate them is great. They are anxious because they are hypoxemic and dyspneic. Additionally, most bronchodilators have central effects which are stimulatory, increasing anxiety. Although some patients can trigger bronchospastic episodes by anxiety, the use of tranquilizers or sedatives is exceedingly dangerous, thus these drugs should not be used. Patients with ROAD do not thrive in the average emergency room environment. They should be kept in a quiet area under constant supervision and frequently reassured that they are receiving adequate care. If this, plus the above therapy is administered, most of these patients will not require admission. Several series have demonstrated that only 2% to 5% of all patients will require admission.

The inpatient management of ROAD, phase three, covers only a very small percentage of the total population of patients at risk; however, if improperly treated during this phase, the mortality is

significant. The question is frequently asked as to which patients should be admitted. The following guidelines are useful:

1. All patients with high normal or elevated  $\text{PaCO}_2$ 's or low pH's, that is, less than 7.30, need admission.
2. Patients with forced expiratory volume in one second ( $\text{FEV}_1$ ) of less than 0.5 liters.  $\text{FEV}_1$ 's are sometimes difficult to measure and equipment is not always readily available, therefore, alternate mechanisms to assess function are needed. McFadden (9) demonstrated that intercostal retraction related well to severe mechanical obstruction and usually disappeared with  $\text{FEV}_1$ 's greater than one liter. Rebuck (8) has shown that pulsus paradoxus of greater than 10 to 12 mm Hg systolic blood pressure correlated well with severe reduction in  $\text{FEV}_1$ . Thus, the presence of retractions and paradox should indicate admission.
3. Patients with prolonged attacks, that is, greater than 12 hours.
4. Patients demonstrating physical exhaustion.
5. Patients who fail to respond to phase two measures within four to six hours.
6. Patients with falling  $\text{PaO}_2$  and rising  $\text{PaCO}_2$  with emergency room management.

Once the decision to admit has been made, the severity of the situation will dictate the best area of the hospital for therapy. Generally, the ICU should be considered as the desired location. The scope of intensive care management is beyond this paper, but several points should be made (2, 4, 6):

1. No sedatives.
2. Continuous  $\text{O}_2$  therapy (best given by nasal cannula) to maintain  $\text{PaO}_2$ , 60 to 70 mm Hg.
3. Frequent arterial gases until the patient is clearly better.
4. Continuous aminophylline I.V. (0.9 mg/kg/hr) after an initial loading dose (5.6 mg/kg/20 min).
5. Inhaled or subcutaneous sympathomimetic drugs, or both, using monitoring of cardiac rate, rhythm, and blood pressure as the controlling factors.
6. ECG monitoring.
7. Adequate hydration, since these patients are almost invariably dehydrated, which causes difficulty in clearing trachea-bronchial secretions. This initially will have to be intraven-

ous. Various estimates of fluid deficit have been made; however, good data is not available. Inpatients with normal cardiovascular-renal mechanisms should have fluid therapy until their secretions are thin and easily cleared.

8. Humidity therapy with warm moist air, if tolerated, will help to loosen secretions.
9. Corticosteroid therapy is a major portion of the therapy and must be given in pharmacologic doses. Methylprednisolone, 250 mg, I.V. Q4h, has been very valuable in this area. It is preferred because of less mineralocorticoid effect, plus a longer half life than hydrocortisone. There are other less well defined reasons for the use of this drug.

The other frequently asked question is, when should these patients be placed on continuous ventilator support? There are several guidelines which are used by most physicians caring for numbers of these patients, and these guidelines are based primarily on arterial blood gas studies. If the  $\text{PaCO}_2$  begins to rise above the normal range (greater than 45 mm Hg) or the pH falls below 7.30 with the above program, these patients are at great risk for respiratory and cardiac arrest, therefore, we electively intubate and assist these patients. Marked depression in the level of consciousness from severe fatigue indicates the need for ventilatory assistance. Continued unremitting bronchospasm with optimal therapy should also be considered an indication for ventilatory assistance.

In summary, reversible obstructive airways disease (ROAD) is a common respiratory problem. Proper education and outpatient management will almost always provide adequate care. However, some patients require more active therapy in emergency rooms or hospitals. Since almost all patients, properly treated, will survive to return to productive life, a well-planned, aggressive therapeutic approach is needed as outlined in this paper.

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