
CHAPTER 3 – RESPIRATORY SYSTEM

First Nations and Inuit Health Branch (FNIHB) Clinical Practice Guidelines for Nurses in Primary Care.
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ASSESSMENT OF THE RESPIRATORY SYSTEM

The following characteristics of each symptom should be elicited and explored:

- Onset (sudden or gradual)
- Chronology
- Current situation (improving or deteriorating)
- Location
- Radiation
- Quality
- Timing (frequency, duration)
- Severity
- Precipitating and aggravating factors
- Relieving factors
- Associated symptoms
- Effects on daily activities
- Previous diagnosis of similar episodes
- Previous treatments
- Efficacy of previous treatments

CARDINAL SYMPTOMS¹

Characteristics of specific symptoms should be elicited, as follows.

COUGH

- Quality (for example, dry, hacking, loose, productive)
- Severity
- Timing (for example, at night, with exercise, in cold air, inside or outside)
- Aggravating/relieving factors

SPUTUM

- Colour
- Amount (in teaspoons, tablespoons, cups)
- Consistency
- Purulence, odour, foul taste
- Time of day worse

HEMOPTYSIS

- Amount of blood
- Frank blood or mixed with sputum
- Association with leg pain, chest pain, shortness of breath

SHORTNESS OF BREATH

- Exercise tolerance (number of stairs client can climb or distance client can walk)
- Shortness of breath at rest
- Inability to converse in phrases or complete sentences
- Marked increase in respiratory effort, use of accessory muscles or retraction
- Orthopnea (number of pillows used for sleeping)
- Association with paroxysmal nocturnal dyspnea (waking up out of sleep acutely short of breath; attack resolves within 20 to 30 minutes of sitting or standing up)
- Timing
- Severity (for example, marked tachypnea)

CHEST PAIN

- Onset (sudden or gradual)
- Location
- Radiation
- Referral pattern
- Quality
- Timing
- Severity
- Aggravating and relieving factors
- Associated symptoms

WHEEZE

- Timing (for example, at rest, at night, with exercise)

OTHER ASSOCIATED SYMPTOMS

- Cyanosis
- Fever
- Fatigue
- Anorexia
- Diaphoresis
- Weight loss

MEDICAL HISTORY (SPECIFIC TO RESPIRATORY SYSTEM)

- Smoking history (number of packages/day, number of years)
- Frequency of colds or asthma and treatment used
- Other respiratory illnesses (for example, nasal polyps, chronic sinusitis)
- Bronchitis, pneumonia, chronic obstructive pulmonary disease (COPD), tuberculosis (TB) (disease or exposure), cancer, cystic fibrosis
- Seasonal allergies, exposure to environmental irritants or allergies to drugs such as acetylsalicylic acid (ASA)
- Medications such as angiotensin-converting enzyme (ACE) inhibitors, β -blockers, ASA, steroids, nasal sprays, antihistamines
- Admissions to hospital for respiratory illness, any intubation needed
- Date and result of last Mantoux test and chest x-ray
- Vaccination history (for example, pneumococcal, annual influenza)

FAMILY HISTORY (SPECIFIC TO RESPIRATORY SYSTEM)

- Others at home with similar symptoms
- Allergies, hypersensitivity
- Asthma, lung cancer, TB, cystic fibrosis
- Heart disease

PERSONAL AND SOCIAL HISTORY (SPECIFIC TO RESPIRATORY SYSTEM)

- Exposure to secondhand smoke
- Occupational or environmental exposure to respiratory irritants (for example, mining, forest-fire fighting)
- Exposure to pets
- Crowded living conditions
- Poor personal or environmental cleanliness
- Institutional living
- Injection drug use
- Alcohol abuse
- HIV risks

EXAMINATION OF THE RESPIRATORY SYSTEM

Examination of the ear, nose, throat and cardiovascular system should also be carried out because of the interrelatedness between these systems and structures and the functioning of the lower respiratory tract (*see the chapters “Ears, Nose and Throat” and “Cardiovascular System” for details of these examinations*).

GENERAL APPEARANCE

- Acutely or chronically ill
- Degree of comfort or distress
- Degree of sweatiness
- Ability to speak a normal-length sentence without stopping to take a breath
- Colour (for example, flushed, pale, cyanotic)
- Nutritional status (obese or emaciated)
- Hydration status

VITAL SIGNS

- Temperature
- Pulse
- Pulse oximetry
- Respiratory rate
- Blood pressure

INSPECTION

- Colour (for example, central cyanosis)
- Shape of chest (for example, barrel-shaped, spinal deformities)
- Movement of chest (symmetry)
- Rate, rhythm and depth of respiration
- Use of accessory muscles (sternocleidomastoid muscles)
- Intercostal/substernal indrawing
- Evidence of trauma
- Chest wall scars
- Clubbing of the fingers

PALPATION

- Tracheal position (midline)
- Chest wall tenderness
- Chest expansion
- Tactile fremitus
- Spinal abnormality
- Nodes (axillary, supraclavicular, cervical)
- Masses
- Subcutaneous emphysema

PERCUSSION

- Resonance (dull or hyperresonance)
- Location and excursion of the diaphragm

AUSCULTATION

- Assist client to breathe effectively
- Listen for sounds of normal air entry before trying to identify abnormal sounds
- Degree of air entry throughout the chest (should be equal)
- Quality of normal breath sounds (for example, bronchial, bronchovesicular, vesicular)
- Length of inspiration and expiration
- *Wheezes*: continuous sounds, ranging from a low-pitched snoring quality to a high-pitched musical quality; may be inspiratory, expiratory, or both; may clear with coughing; may be present only on forced expiration
- *Crackles*: discrete, crackling sounds heard on inspiration; may clear with coughing
- *Pleural rub*: a creaking sound from pleural irritation, heard on inspiration or expiration

DIFFERENTIAL DIAGNOSIS OF RESPIRATORY SYMPTOMS

ACUTE COUGH

- Infection: viral or bacterial, upper or lower respiratory tract
- Asthma
- Exacerbations of chronic bronchitis
- Bronchogenic carcinoma
- Foreign-body inhalation
- Esophageal reflux with aspiration
- Left-sided heart failure

CHRONIC COUGH

COMMON CAUSES

- Smoking
- Exposure to environmental irritants (secondhand smoke)
- Postnasal drip
- Postviral airway inflammation
- Asthma
- COPD or chronic bronchitis
- Gastroesophageal reflux with aspiration
- Lung tumours

LESS COMMON CAUSES

- Carcinoma of the upper or lower respiratory tract
- Interstitial lung disease
- Medications (for example, ACE inhibitors)
- Chronic lung infections (for example, bronchiectasis, cystic fibrosis, TB, lung abscess)
- Occult left heart failure
- Thyroid disorders
- Disorders of the pleura, pericardium, diaphragm, stomach
- Idiopathic (psychogenic)
- Pressure from an external mass (for example, thyromegaly, aortic aneurysm)

COUGH AND SPUTUM PRODUCTION

- Acute bronchitis
- Pneumonia
- Asthma
- TB
- COPD
- Bronchiectasis
- Lung abscess
- Lung cancer

DYSPNEA

- Asthma
- COPD
- Pneumothorax
- Pneumonia
- Interstitial lung disease (for example, sarcoidosis)
- Lung cancer
- Pulmonary emboli or infarction
- Cardiac failure, congestive heart failure
- Anxiety with hyperventilation

HEMOPTYSIS

- Bronchitis
- Bronchiectasis
- Cystic fibrosis
- Tuberculosis
- Bronchogenic cancer
- Lung abscess
- Pneumonia, necrotizing form (caused by *Klebsiella*)
- Pulmonary contusion
- Pulmonary embolism
- Systemic lupus erythematosus
- Primary pulmonary hypertension
- Mitral stenosis
- Cardiac failure, congestive heart failure
- Vascular anomalies (for example, aneurysm)
- Chest trauma
- Inhalation of toxic material
- Bleeding disorders

WHEEZE

- Acute bronchitis
- COPD
- Asthma
- Bronchopneumonia (due to aspiration)
- Lung neoplasm obstructing a bronchus
- Pulmonary emboli
- Foreign-body aspiration
- Acute congestive heart failure (rare)

CHEST PAIN (PLEURITIC)

DISEASES OF THE LUNGS OR PLEURA

- Pneumonia
- Pleurisy
- Pleuritis associated with connective tissue diseases
- Pneumothorax
- Hemothorax
- Empyema
- Pulmonary infarction
- Neoplasm of lungs
- Tuberculosis

DISEASES OF THE PERICARDIUM

- Pericarditis
- Trauma
- Postmyocardial infarction (Dressler's syndrome)

DISEASES OF THE CHEST WALL MUSCLE, BONE, NERVES, SKIN

- Chest wall contusion
- Fractures of ribs, sternum
- Inflammation of chest wall muscles (costochondritis)
- Herpes zoster neuropathies
- Bone tumour

GASTROINTESTINAL DISEASES

- Liver abscess
- Pancreatitis
- Subdiaphragmatic abscess

OTHER DISEASES

- Psychoneurosis

CHEST PAIN (NONPLEURITIC)

DISEASES OF THE PULMONARY VESSELS

- Pulmonary embolism
- Primary pulmonary hypertension
- Disease of the aorta
- Dissecting aortic aneurysm

DISEASES OF THE MYOCARDIUM

- Myocardial infarction
- Angina
- Cardiomyopathies (myocarditis)
- Mitral valve prolapse

REFERRED PAIN FROM GASTROINTESTINAL STRUCTURES

- Reflux esophagitis, ulceration
- Esophageal motility disorders (for example, achalasia)
- Esophageal perforation or rupture
- Esophageal spasm
- Esophageal neoplasm
- Esophageal diverticula
- Gastric or duodenal ulcer
- Cholelithiasis, cholecystitis
- Pancreatitis, pancreatic neoplasm

COMMON PROBLEMS OF THE RESPIRATORY SYSTEM

CHRONIC ASTHMA

A disorder of the airways characterized by paroxysmal or persistent symptoms (including dyspnea, chest tightness, wheeze and cough) with variable airflow limitation, airway inflammation and airway hyperresponsiveness to a variety of stimuli.

CAUSES

- Unknown in many cases
- Allergic airway hyperreactivity to airborne pollens, molds, house dust mites, animal dander, feather pillows
- Nonallergic asthma triggered by drugs (such as acetylsalicylic acid [ASA], nonsteroidal anti-inflammatory drugs [NSAIDs], β -blockers and angiotensin-converting enzyme [ACE] inhibitors), smoke and other occupational inhalants, dietary sulfites (found in foods such as dried fruit, beer and wine), industrial and environmental substances
- Common trigger factors: intercurrent respiratory tract infections, cold air, exercise, emotional stress, sinusitis, gastroesophageal reflux disease (GERD)

Risk Factors

- Positive family history
- Frequent, severe viral infections of the lower respiratory tract in infancy
- Overcrowded housing
- Dust/mold/poor status of housing (for example, exposed walls, insulation, increased humidity)

DETERMINING SEVERITY

The severity of asthma is determined by the frequency and chronicity of symptoms, the presence of persistent airflow limitations and the medication needed to maintain control of the condition. Severity is best evaluated after an aggressive trial of therapy with inhaled corticosteroids (*see Table 1, “Characteristics of Various Forms of Chronic Asthma”*).

Table 1 – Characteristics of Various Forms of Chronic Asthma

Controlled Asthma	Partly Controlled Asthma	Uncontrolled Asthma
Daytime symptoms (wheeze, cough, dyspnea) twice or less weekly	Daytime symptoms > 2 times weekly	Three or more features of partly controlled asthma present in any given week
No night-time symptoms/awakenings	Any night-time symptoms/awakenings	
No limitations of activities	Any limitation of activities	
PEFR and FEV1 > 80% of predicted	PEFR < 80% of predicted or personal best (if known)	
No exacerbations	One or more exacerbations per year	One exacerbation in any week
Need for rescue medication twice or less weekly	Need for rescue medication more than twice a week	

PEFR = peak expiratory flow rate; FEV1 = forced expiratory volume in the first second.

Note: Cough at night or during times of emotional stress or physical activity may be the only sign of asthma.

DIFFERENTIAL DIAGNOSIS

- Mechanical airway obstruction (foreign body)
- Severe allergic reaction
- Chronic obstructive pulmonary disease (COPD) with chest infection
- Congestive heart failure
- Pulmonary edema
- Inhalation of toxic material
- Laryngeal dysfunction
- Cough secondary to drugs such as ACE inhibitors

COMPLICATIONS

- Severe acute attack: hypoxia, respiratory distress which may progress to respiratory failure, atelectasis, pneumothorax, death
- Chronic: interference with activities of daily living, COPD

DIAGNOSTIC TESTS

Objective measurements are needed to confirm a diagnosis of asthma and to assess severity in all but the most minimally symptomatic clients. The following tests should be carried out (these tests should be ordered by the consulting physician).

- Arrange baseline pulmonary function tests
- Determine peak expiratory flow rate (PEFR)
- Arrange histamine or methacholine challenge test
- Arrange allergy testing²

MANAGEMENT

Goals of Treatment

- Maintain normal activity
- Prevent symptoms
- Maintain normal pulmonary function
- Prevent exacerbations
- Avoid side effects of therapy (given that side effects may lead to poor adherence to treatment plan)

Appropriate Consultation

Consult a physician for all previously undiagnosed cases. The timing of this consult depends on the severity of the client's symptoms (whether the client requires immediate pharmacologic treatment).

Ideally, a physician should review the client at least annually once stable, and more often if symptoms are not well controlled.

Adjuvant Therapy

- Administer annual influenza vaccine and other influenza vaccines according to the current flu season (for example, H1N1 vaccine)
- Administer pneumococcal vaccine

Nonpharmacologic Interventions

- Recommend that client avoid known precipitating factors such as environmental allergens and occupational irritants
- Offer counselling for smoking cessation (if applicable)
- Recommend that client avoid NSAIDs and ASA products

Client Education

- Discuss diagnosis and expected course of illness
- Counsel client about appropriate use of medications (dose, frequency, side effects)
- Advise client on proper use of delivery device, aerochamber/spacer as appropriate
- Teach client how to monitor for symptoms and how to use peak flow meter (if deemed beneficial to managing symptoms)
- Advise client on an action plan to increase medication from maintenance level at first sign of exacerbation
- Educate about acute exacerbation symptoms and presenting to clinic immediately
- Counsel client on how to minimize local side effects (oral candidiasis) by careful rinsing of the mouth and gargling

Pharmacologic Interventions³**Recommended Drug Treatment for Chronic Asthma****Inhaled corticosteroids**

For example, fluticasone (Flovent), beclomethasone (Qvar)

+

Long-acting β_2 -agonists

For example, formoterol (Oxeze) or salmeterol (Serevent), if symptoms are not controlled with an inhaled corticosteroid, especially at night

+

Short-acting β_2 -agonists

salbutamol (Ventolin), prn for breakthrough symptoms

+

Oral steroids

For example, prednisone

(used to treat acute exacerbations [i.e., PEFR < 60% of predicted] when response to an increase in inhaled steroid is inadequate)

Inhaled Corticosteroids

Inhaled corticosteroids are the best agents for bringing and keeping asthma under control, and their use may improve the overall prognosis for clients with this condition.

Initial recommended doses of inhaled corticosteroid for mild to moderate asthma (dosing depends on patient presentation and may need to be increased or decreased accordingly). Examples:

fluticasone (Flovent), 250–1000 μg daily, divided bid
or

beclomethasone (QVAR) 200–500 μg daily, divided bid

Once best results are achieved (symptoms are controlled), the dose of inhaled steroid is reduced to identify the minimum dose required to maintain control.

Inhaled steroids are safe for use during pregnancy and lactation, but the lowest dose possible to maintain control of asthma is recommended.

Long-Acting β_2 -Agonists

The long-acting β_2 -agonists (for example, salmeterol, formoterol) can be used as an additional treatment for people whose asthma is not adequately controlled with optimum inhaled steroids, particularly when there are nocturnal symptoms.

Combination inhalers containing both an inhaled corticosteroid with a long-acting β_2 -agonist are available, for example, Advair. These combinations must be ordered by a physician.

Short-Acting β_2 -Agonists

Short-acting β_2 -agonists are the drugs of choice to relieve asthma symptoms that break through maintenance therapy. They are most effective for preventing and treating exercise-induced bronchospasm. Their use should be limited to urgent relief of acute symptoms. Inhaled steroids are indicated if short-acting β_2 -agonists are needed more than 2 times a week to control acute symptoms.

salbutamol (Ventolin), 100 μg /puff, 1 or 2 puffs q4h prn

Leukotriene Receptor Antagonists (LTRA)

Leukotriene receptor antagonists such as zafirlukast (Accolate) or montelukast (Singulair) have anti-inflammatory properties but are not as effective in improving symptoms as inhaled corticosteroids. Mild asthmatics who refuse or cannot take inhaled corticosteroids may try an LTRA. They may also be considered as alternatives to increasing doses of inhaled corticosteroids in patients not controlled on low-moderate doses or may be used with higher doses of inhaled corticosteroids for symptom control.

Anticholinergics

Anticholinergic drugs (for example, ipratropium bromide [Atrovent]) are not routinely indicated in asthma. They are of greatest value in treating older patients and patients with a combination of asthma and COPD. They are also an alternative for clients who get tremors and tachycardia when using salbutamol (Ventolin). During acute exacerbations they are used as an adjunct to optimal doses of short-acting β_2 -agonists.

Monitoring and Follow-Up

- Follow up every 3–6 months once stabilized
- Assess adherence to the medication regimen
- Review inhaler technique periodically
- Watch for complicating conditions such as GERD, sinusitis, nasal polyps
- Bone densitometry is suggested in patients who require high doses of inhaled corticosteroids or have risk factors for osteoporosis. Patients with personal or family history of glaucoma requiring high-dose inhaled corticosteroids should have IOP checked soon after starting therapy and periodically thereafter. Greater than 1000 μg /day of beclomethasone, 500 μg /day of fluticasone or equivalent is considered high-dose inhaled corticosteroid.³ Review strategies to reduce environmental allergens if applicable (for example, reduce dust mites, stop smoking, minimize humidity, remove furred pets)

Referral

Consult physician regarding referral to a respiratory specialist for adults when more than 1000 μg daily of inhaled beclomethasone, 500 μg /day of fluticasone or equivalent is required on an ongoing basis.

Consider referral to a pulmonary rehabilitation program (if available) for clients whose activities of daily living are significantly compromised by poorly controlled symptoms despite adequate therapy and adequate compliance with the treatment plan.

ACUTE ASTHMA EXACERBATION

Exacerbations should be treated promptly to reverse the symptoms and prevent them from becoming severe.

The findings depend on the acuteness and severity of the attack, which can range from mild to very severe.

MILD ASTHMA EXACERBATION

HISTORY

- Exertional dyspnea, no acute distress
- Cough

PHYSICAL FINDINGS

- Respiratory rate normal or minimally elevated
- Heart rate < 100 bpm
- Low-pitched wheezes (inspiratory or expiratory, or both)
- Forced expiratory volume in the first second (FEV_1) and PEFr > 60% predicted or best
- PEFr > 300 L/min
- Good response (usually) to short-acting β_2 -agonists

MANAGEMENT

Appropriate Consultation

Consult a physician as necessary for advice regarding adjustments to current medications.

Pharmacologic Interventions

- If client uses inhaled steroids regularly as prescribed, during an exacerbation the dose may need to be increased to 2–4 times the usual
- If client has not been taking prescribed asthma medications recently, restart usual dose
- Bronchodilation as necessary to reduce bronchospasm:

salbutamol (Ventolin), by metered-dose inhaler (MDI) with AeroChamber, 1 or 2 puffs q4h prn, to a maximum of 2–4 puffs q4h (higher doses may be needed in more severe exacerbations)

The nebulized form offers no advantage over an MDI with AeroChamber or dry powder inhalers.⁴ However, nebulizers are sometimes used in patients who remain symptomatic despite maximal treatment with handheld inhalers.

Monitoring and Follow-Up

Advise follow-up in 24 hours if symptoms are not controlled.

For exercise or cold-induced asthma:

salbutamol (Ventolin), 1 or 2 puffs 10–15 minutes before exercising or going out in the cold air

MODERATE ASTHMA EXACERBATION

HISTORY

- Dyspnea at rest
- Congested cough
- Tightness of the chest
- Nocturnal symptoms
- β_2 -agonists needed > q4h

PHYSICAL FINDINGS

- Appears short of breath
- Respiratory rate elevated
- Heart rate > 100 bpm
- Some use of accessory muscles of respiration
- Audible wheeze
- High-pitched wheezes in all lung fields (inspiratory or expiratory, or both)
- FEV₁ and PEFr 40% to 60% predicted or best
- PEFr 200–300 L/min
- β_2 -agonists provide only partial relief

MANAGEMENT

Appropriate Consultation

Consult physician as soon as possible after **initiating emergency treatment**.

Adjuvant Therapy

Start oxygen by non-rebreather mask; titrate flow to keep oxygen saturation > 94%.

*Pharmacologic Interventions*⁵

salbutamol (Ventolin) by MDI and AeroChamber, 100 µg/puff, 4–8 puffs q15–20min, 3 times

(additional doses as per physician consultation)

and

ipratropium bromide (Atrovent) by MDI and AeroChamber, 20 µg/puff, 4–8 puffs q15–20min, 3 times

(additional doses as per physician consultation)

*NB: the MDI form of ipratropium bromide contains soy lecithin and is contraindicated in people with peanut allergy

±

prednisone (Prednisone), 40–60 mg PO

(additional doses as per physician consultation)

People with steroid-dependent asthma and those who are already receiving inhaled steroids should also receive oral steroid therapy.

Monitoring and Follow-Up

PEFR and FEV₁ should be checked frequently to evaluate response to bronchodilator therapy.

Client may be discharged after the initial emergency treatment if there is good response and there has been no attack within the previous 24 hours.

Referral

Consult for medevac if, after treatment, the FEV₁ reading is < 60% predicted value or there has been another attack within the previous 24 hours.

SEVERE ASTHMA EXACERBATION

HISTORY

- Acute respiratory distress
- Agitated, diaphoretic
- Difficulty speaking (unable to complete sentences)

PHYSICAL FINDINGS

- Heart rate > 110 bpm
- Marked use of accessory muscles of respiration
- Blood pressure elevated
- Breath sounds decreased in intensity
- Diffuse, high-pitched wheezes (inspiratory or expiratory, or both)
- FEV₁ and PEFr: unable to perform test or < 40% predicted or best
- PEFr < 200 L/min
- Oxygen saturation < 90%
- No pre-clinic relief afforded by β_2 -agonists

Caution: Beware of the “silent chest” (poor air entry, no wheezing) in a patient with a history of asthma who presents in acute respiratory distress. Such a person is status asthmaticus, which is the most severe and dangerous form of asthma.

MANAGEMENT

This is respiratory emergency, think of ABC – airway, breathing and circulation.

Initiate oximetry and cardiac monitoring (if available).

Adjuvant Therapy

- Start oxygen by non-rebreather mask
- Titrate flow to keep oxygen saturation > 94%
- Start intravenous (IV) therapy with normal saline; run at 250 mL/h for the first hour
- Aggressive fluid administration can help liquefy bronchial secretions and replace insensible losses with tachypnea and dyspnea (unless otherwise contraindicated)

Appropriate Consultation

Consult a physician as soon as possible after initiating emergency treatment.

Pharmacologic Interventions

salbutamol (Ventolin) by MDI and AeroChamber, 100 µg/puff, 4–8 puffs q15–20min, 3 times;

(additional doses dependent on response and physician consultation)

+

ipratropium bromide (Atrovent) by MDI and AeroChamber, 20 µg/puff, 4–8 puffs q15–20min, 3 times;

(additional doses as per physician consultation)

***NB:** the MDI form of ipratropium bromide contains soy lecithin and is contraindicated in people with peanut allergy

+

methylprednisolone (Solu-Medrol) 60–80 mg IV or prednisone 40–60 mg PO

(additional doses as per physician consultation)

Monitoring and Follow-Up

Assess response to medication by continuously monitoring oxygen saturation and by measuring PEFr and vital signs frequently. Also monitor work of breathing and mental status. Patient may tire with respiratory effort and require assisted ventilation with Ambu bag.

Referral

Medevac as soon as possible.

Patients at Risk of Relapse

- Previous near-death episode
- Recent emergency room visit for acute exacerbation
- Frequent admissions to hospital, past intubations
- Dependent on steroids and recent use of oral steroids
- History of sudden attacks
- Allergic or anaphylactic triggers
- Recent attack of prolonged duration
- Poor understanding of illness and poor adherence to therapy
- No removal of environmental triggers

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

A functional disorder of the lung characterized by progressive and persistent airflow obstruction and actual destruction of lung tissue.

CAUSES

- Usually a combination of factors

Risk Factors

- Smoking
- Second-hand smoke
- Severe viral pneumonia early in life
- Aging
- Genetic predisposition
- Air pollution
- Occupational exposure to respiratory irritants

FORMER CLASSIFICATION

Most clients with COPD have a combination of chronic bronchitis and emphysema. However, one pattern is predominant: people with COPD either tend to have more cough and sputum production and less shortness of breath (chronic bronchitis) or tend to have more shortness of breath and less cough and sputum production (emphysema).

Chronic Bronchitis

Chronic productive cough that is present for at least 3 months each year, for 2 years in a row. Initially, cough and sputum are present only in the morning (especially in the winter). Eventually the symptoms are present throughout the day and throughout the year. There are frequent episodes of acute chest infections superimposed on the chronic condition.

Emphysema

Chronic shortness of breath, initially with exercise. Cough is only a minor problem and sputum production is limited. The shortness of breath gradually becomes worse until the person is short of breath even at rest.

HISTORY

- Client almost always a smoker
- 40 years of age or older
- Frequent chest infections
- Weight loss and fatigue (in the advanced stages)
- Shortness of breath
- Cough with sputum (clear, white, yellow-green)
- Wheeze

PHYSICAL FINDINGS

Physical findings vary, depending on extent of disease and whether exacerbation is acute.

The upper respiratory tract (for example, ears, nose and throat) and the cardiovascular system should be examined, and neuromental status should be determined (to check for hypoxia).

- Temperature may be elevated with acute infection
- Heart rate may be elevated
- Respiratory rate elevated, depth of respiration may be decreased
- Expiratory phase may be prolonged
- Oxygen saturation may be reduced
- Client may appear thin or wasted
- Degree of respiratory distress varies
- May be using accessory muscles of respiration
- Cyanosis may occur
- Clubbing of fingers may be present
- Chest diameter may increase (“barrel chest”)
- Breathing may be pursed-lipped
- If hypoxia is significant, confusion, irritability and diminished level of consciousness may result

- Tactile fremitus decreased
- Chest excursion decreased
- Hyperresonance
- Decreased diaphragmatic excursion (chronically hyperinflated lungs)
- Air entry reduced
- Breath sounds distant (if barrel chest is present)
- Scattered wheezes and crackles may be present
- Decreased FEV₁ on peak flow testing

DIFFERENTIAL DIAGNOSIS

- Bronchitis (acute)
- Bronchiectasis
- Asthma
- Bronchogenic carcinoma
- Idiopathic pulmonary fibrosis

COMPLICATIONS

- Acute bronchitis
- Pneumonia
- Pulmonary hypertension
- Cor pulmonale (right heart failure)
- Respiratory failure
- Polycythemia (abnormally high hemoglobin)

DIAGNOSTIC TESTS

Baseline chest x-ray, non-urgent consult with physician to arrange for baseline pulmonary function testing.

MANAGEMENT**Goals of Treatment**

- Reduce or eliminate dyspnea
- Reduce sputum production
- Improve exercise tolerance
- Prevent progression of disease
- Reduce frequency and severity of exacerbations
- Keep oxygen saturation > 90%

Appropriate Consultation

Consult a physician for previously undiagnosed clients, those whose symptoms are not controlled with their current therapy and those with an acute exacerbation.

Nonpharmacologic Interventions

Client Education

- Early public education about the hazards of smoking can prevent COPD
- Counsel client about smoking cessation (if applicable)
- Recommend adequate hydration (6–8 glasses of fluid per day; there is no evidence that drinking more than this quantity is of any benefit)
- Recommend increasing room humidity (client should keep a pot of water on the stove, especially in the winter)
- Recommend adequate nutrition: frequent, smaller meals high in protein and calories
- Recommend an exercise program (for example, walking) to improve general fitness and sense of well-being
- Recommend a weight-loss program (if applicable)
- Discuss natural history, expected course and prognosis of disease
- Counsel client about appropriate use of medications (purpose, dose, frequency, side effects)
- Counsel client about proper use of inhaler
- Perform chest physiotherapy (deep breathing and coughing, pursed-lip breathing, abdominal breathing and postural drainage)
- Teach client symptoms and signs of exacerbation and acute infection to encourage self-monitoring and early presentation when condition deteriorates
- Counsel client to avoid travel at high altitudes; when air travel cannot be avoided, the client should have access to oxygen (especially when travelling in an unpressurized aircraft)

Adjuvant Therapy

- Consider home oxygen therapy for clients with significant hypoxemia (PaO₂ of 55 mmHg or less or an SaO₂ less than 88%). Oxygen therapy can increase lifespan by 6–7 years⁶
- Give yearly influenza vaccine to all clients with COPD
- Give pneumococcal vaccine

Pharmacologic Interventions

Recommended Drug Treatment for COPD⁷

Mild Disease. Start with:

SABD (short-acting bronchodilator) for example, ipratropium bromide (Atrovent) PRN

If persistent dyspnea:

LAAC (long-acting anticholinergic), for example, tiotropium (Spiriva) *and* a short-acting β_2 -agonist (**SABA**), for example, salbutamol (Ventolin) PRN

or

LABA (long-acting β_2 -agonist), for example, salmeterol (Servent) *and* a short-acting bronchodilator (**SABD**), for example, ipratropium bromide (Atrovent) PRN

Moderate Disease (< 1 acute exacerbation of chronic obstructive pulmonary disease per year, use:

LAAC (long-acting anticholinergic), for example, tiotropium (Spiriva) *or* a **LABA** (long-acting β_2 -agonist), for example, salmeterol (Servent)

and

SABA (short-acting β_2 -agonist), for example, salbutamol (Ventolin) PRN

If persistent dyspnea:

LAAC (long-acting anticholinergic), for example, tiotropium (Spiriva) *and* a **LABA** (long-acting β_2 -agonist), for example, salmeterol (Servent)

and

SABA (short-acting β_2 -agonist), for example, salbutamol (Ventolin) PRN

If still symptomatic despite optimal bronchodilators, inhaled corticosteroids being added:

LAAC (long-acting anticholinergic), for example, tiotropium (Spiriva) *and* **ICS/LABA** (inhaled corticosteroid/long-acting β_2 -agonist) for example, fluticasone/salmeterol (Advair)

and

SABA (short-acting β_2 -agonist), for example, salbutamol (Ventolin) PRN

Severe Disease (> 1 acute exacerbation of chronic obstructive pulmonary disease per year):

LAAC (long-acting anticholinergic), for example, tiotropium (Spiriva) *and* **ICS/LABA** (inhaled corticosteroid/long-acting β_2 -agonist) for example, fluticasone/salmeterol (Advair)

and

SABA (short-acting β_2 -agonist), for example, salbutamol (Ventolin) PRN

+/-

Theophyllines, for example, Uniphyll

Monitoring and Follow-Up

- Follow up every 6 months if stable
- Follow up monthly if symptoms poorly controlled

Referral

The physician should assess the client at least annually if condition is stable, and as soon as feasible if symptoms are not controlled.

Consider referral to a pulmonary rehabilitation program (if available).

ACUTE COPD EXACERBATION

Recent deterioration of the patient's clinical and functional state due to a worsening of his or her COPD.

HISTORY

- Worsening dyspnea, sometimes at rest
- Increased cough
- Increased sputum production, often with change in character from mucoid to purulent
- Development of or increase in wheezing
- Loss of energy
- Anorexia
- Fever
- Increase in respiratory rate
- Tachycardia
- Increase in cyanosis
- Use of accessory muscles
- Peripheral edema
- Loss of alertness
- Worsening of airflow obstruction, as indicated by FEV₁ or PEFr
- Worsening of oxygen saturation, as indicated by pulse oximetry

EVIDENCE OF SEVERE EXACERBATION

Loss of alertness or a combination of two of the other typical symptoms and signs of COPD exacerbation suggests severe exacerbation and a need for referral to the emergency department. These criteria are not intended to replace a health care provider's judgment about the need for referral.

MANAGEMENT

The decision as to whether to manage a client at home or to refer him or her for evaluation depends on many factors: the severity of the exacerbation; the severity of the underlying COPD; comorbid conditions; the medical sophistication, judgment and reliability of the client and caregivers; and the distance the client lives from the health centre or clinic.

Exacerbations should be treated with appropriate supplemental oxygen, aggressive bronchodilator therapy, corticosteroids and antibiotics.

Appropriate Consultation

Consult a physician as soon as possible.

Adjuvant Therapy

- Oxygen (low flow) via Venturi mask; use a 24% mask initially; titrate concentration and litres of flow to keep oxygen saturation at 90% to 92%
- Watch for signs of respiratory depression
- Start IV therapy with normal saline; adjust IV rate according to state of hydration

Pharmacologic Interventions

The choice of medications and dosages (*see "Recommended Drug Treatment for Acute Exacerbation of COPD"*) depends on the current drug regimen and the client's adherence to it, as well as the severity of the exacerbation (particularly the degree of respiratory distress).

The maximal effective doses of SABA (short-acting β_2 -agonists) (for example, salbutamol) and SABD (short-acting bronchodilator) (for example, ipratropium bromide) in COPD exacerbation are unknown. Appropriate use of MDIs with or without spacer devices or dry powder devices provides optimal drug delivery and should be encouraged over nebulizers. However, nebulizers are sometimes used in patients who remain symptomatic despite maximal treatment with handheld inhalers.

Recommended Drug Treatment for Acute Exacerbation of COPD

SABA (short-acting β_2 -agonists) for example, salbutamol (Ventolin), 3 or 4 puffs q4h prn; may increase to 6–8 puffs q2h in severe exacerbation

+

SABD (short-acting bronchodilators) for example, ipratropium bromide (Atrovent), 2–4 puffs qid prn; may increase to 6–8 puffs tid-qid if tolerated and if necessary

+

Oral steroids, for example, prednisone (Prednisone), 30–40 mg PO od for 10–14 days

+/-

Oral antibiotics for simple, uncomplicated COPD exacerbation without risk factors (for example, diabetes) for example, amoxicillin (Amoxil), 500 mg PO tid for 7–10 days

or

sulfamethoxazole/trimethoprim (Septra DS), 1 tab PO bid for 7–10 days

Complicated severe COPD exacerbations (with risk factors) may require broader spectrum antibiotics, such as fluoroquinolones (levofloxacin), second- or third-generation cephalosporins (for example, cefuroxime) or macrolides (for example, azithromycin [Zithromax]). Consult a physician for choice of antibiotic.

Monitoring and Follow-Up

Monitor vital signs, oxygen saturation and PEFr frequently to assess response to bronchodilator therapy.

Referral

Medevac any client who shows signs of respiratory distress.

ACUTE BRONCHITIS

Inflammation of trachea and bronchi (larger airways).

CAUSES

- Viral infection (90% of cases): influenza A or B, adenovirus, rhinovirus, parainfluenza, coronavirus, respiratory syncytial viruses (RSV)
- Bacterial infection (5–10% of cases): *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, *Bordetella pertussis*, *Streptococcus pneumoniae* (in those with underlying lung disease)

Risk Factors

- Chronic sinusitis
- COPD
- Bronchiectasis
- Immunosuppression
- Smoking
- Secondhand smoke
- Air pollutants
- Alcoholism
- GERD

HISTORY

- Previous infection of upper respiratory tract
- General malaise
- Fever
- Cough; initially dry, later productive of white, yellow or green sputum
- Muscular aching in the chest wall or discomfort with coughing
- Wheezing may be present

PHYSICAL FINDINGS

The presentation of acute bronchitis and pneumonia are often similar. In general, clients with pneumonia are sicker and usually have more chest abnormalities. Bronchitis involves the larger airways, whereas pneumonia involves the smaller airways and air sacs.

- Temperature may be mildly to moderately elevated
- Heart rate may be mildly elevated if febrile
- Respiratory rate may be slightly elevated
- Spasmodic cough
- Rhinitis may be present
- Expiratory phase may be slightly prolonged
- Wheezes (scattered, low pitched) may be present

DIFFERENTIAL DIAGNOSIS

- Influenza
- Acute sinusitis
- Pneumonia
- Acute exacerbation of chronic bronchitis
- Asthma
- Allergies
- Inhaled or aspirated chemical irritants
- Tuberculosis (TB) or lung cancer (if recurrent)
- Pertussis
- Cystic fibrosis

COMPLICATIONS

- Pneumonia
- Postbronchitis cough

DIAGNOSTIC TESTS

- None

MANAGEMENT**Goals of Treatment**

- Relieve symptoms
- Rule out pneumonia
- Limit use of unnecessary antibiotics

Appropriate Consultation

Consultation is usually not necessary if the person is otherwise healthy.

Nonpharmacologic Interventions

- Increased rest (especially if febrile)
- Adequate hydration: 6–8 glasses of fluid per day
- Increased humidity in the environment
- Avoidance of pulmonary irritants (for example, stop or decrease smoking, perfumes)

Client Education

- Recommend hand-washing to prevent spread of infection throughout a household
- Inform client that cough may persist for 2 or more weeks
- Inform client that routine antibiotic treatment is not necessary or recommended

Pharmacologic Interventions

For fever or pain:

acetaminophen (Tylenol), 325 mg, 1 tab q4h prn

Clients who have been unwell for more than 10–14 days and have purulent sputum, or those with underlying health concerns (for example, asthma) may require a course of antibiotics. Consult a physician to discuss use of antibiotics since pertussis must be ruled out.

If bronchospasm is significant, short-acting β_2 -agonist bronchodilators can be used until acute symptoms resolve:

salbutamol (Ventolin), 1 or 2 puffs q4h prn via AeroChamber

Monitoring and Follow-Up

Arrange for follow-up in 5–7 days if not resolving.

Referral

Usually not necessary. Refer if client does not respond to initial treatment or if the condition is complicated by other comorbid risk factors.

COMMUNITY-ACQUIRED PNEUMONIA (CAP)

Infection of the distal airways, air sacs or both.

CAUSES

In the past, cases of pneumonia were divided into two categories, bacterial or atypical. In community-based practices, the following classification of community-acquired pneumonia is now commonly used.

- Previously healthy adult under 65 years of age (or both): *Streptococcus pneumoniae* (pneumococcal) and *Mycoplasma* are the most common organisms; also, less frequently, *Chlamydia pneumoniae* and *Hemophilus influenzae*
- Elderly/comorbid illness (or both): *Hemophilus influenzae*, *Klebsiella pneumoniae*, *Legionella pneumophila*, *Moraxella catarrhalis*, *Mycobacterium tuberculosis*, *Staphylococcus aureus* and, less commonly, *Streptococcus pneumoniae*
- Viral pneumonia uncommon except in outbreaks of influenza A and respiratory syncytial virus (RSV) or as a complication of atypical measles
- Immunocompromised patients: Cytomegalovirus (CMV) and herpes simplex viruses (HSV), *Pneumocystis carinii* (especially those with AIDS)
- Aspiration of oral pharyngeal secretions, gastric contents or chemicals may predispose a patient to bacterial pneumonia. Those at risk for this problem include alcoholic people, elderly people, those who have difficulty swallowing, those with motility or neuromuscular disorders and stroke victims. Commonest organisms are *Klebsiella*, *S. aureus*, *Enteric organisms*, *Anaerobes*, *Gram-negative bacilli*
- No cause is identified in approximately one-third to one-half of all cases

HISTORY

There is considerable overlap in the symptoms of the various types of pneumonias.

- Fever, chills
- Cough
- Sputum may be yellow, green, blood-tinged
- Chest pain: sharp, localized pleuritic chest pain is seen in acute lobar type only
- Shortness of breath may be present

In elderly or chronically ill clients, the symptoms may not be as acute or as obvious. These clients may present with only confusion or a deterioration of pre-existing medical problems.

As a general rule, pneumonia caused by *Mycoplasma*, *Chlamydia*, viruses and *P. carinii* have a slower, more insidious onset. The client may not appear as acutely ill and may have a lower fever, dry cough and scanty sputum production.

PHYSICAL FINDINGS

- Temperature elevated
- Heart rate elevated
- Respiratory rate increased
- Oxygen saturation decreased
- May or may not appear acutely ill
- Flushed, diaphoretic if fever is high
- May “splint” the affected side if there is pleuritic pain
- Variable level of respiratory distress
- Dullness on percussion if there is consolidation
- Air entry may be decreased
- Inspiratory crackles
- Wheezes may be present
- Bronchial breathing
- Pleural rub may be present (rarely)

In elderly clients, the clinical presentation of the various types of pneumonias is often atypical or obscured. Overt respiratory signs may be absent. They may present with changes in level of consciousness, confusion, functional impairment such as loss of energy, a decrease in appetite or vomiting. These clients are at increased risk of death from bacterial pneumococcal disease.

DIFFERENTIAL DIAGNOSIS

- COPD
- Acute bronchitis
- Underlying TB
- Underlying lung cancer
- Aspiration pneumonia
- Lung abscess
- Atelectasis

COMPLICATIONS

- Decompensation of other medical problems
- Respiratory failure from hypoxia
- Sepsis (bacteremia)
- Metastatic infection such as meningitis, endocarditis, pericarditis, peritonitis, empyema
- Renal failure
- Cardiac failure

DIAGNOSTIC TESTS

- Chest x-ray (posteroanterior and lateral) only if diagnosis is clinically obscure or diagnosis is uncertain

MANAGEMENT**Goals of Treatment**

- Relieve symptoms
- Improve or prevent respiratory distress
- Prevent complications

Appropriate Consultation

Consult a physician for any client who appears acutely ill or who has a significant amount of hemoptysis; has signs of respiratory distress; has a significant comorbid condition such as COPD, diabetes mellitus, heart disease, renal disease or cancer; and for any client who has not responded to initial oral treatment and whose condition is worsening.

Nonpharmacologic Interventions

- Increased bed rest
- Adequate fluid intake: 6–8 glasses of fluid per day
- Increased humidity in the air (kettle, humidifier or pot of water on the stove)

Client Education

- Explain diagnosis and expected course of illness
- Counsel client about appropriate use of medications (dose, frequency, side effects)

Pharmacologic Interventions⁸

For fever, pain and muscle ache:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4–6h prn

Antibiotics for client with no comorbid conditions and mild-to-moderate pneumonia:

erythromycin 2 g orally divided bid, tid or qid for 7–10 days

or

azithromycin (Zithromax), 500 mg on day one, then 250 mg PO daily for 4 days

Antibiotics for client with comorbid illness (COPD), mild-to-moderate pneumonia and no antibiotic or oral steroid use in the past 3 months:

azithromycin (Zithromax), 500 mg on day one, then 250 mg PO daily for 4 days

Antibiotics for client with comorbid illness (COPD), mild-to-moderate pneumonia and antibiotic use in the past 3 months:

amoxicillin/clavulanate (Clavulin), 875 mg PO bid for 7–10 days

and

azithromycin (Zithromax), 500 mg on day one, then 250 mg PO daily for 4 days

or

levofloxacin (Levaquin), 500 mg PO q24h for 10 days

Antibiotics for client with suspected aspiration:

amoxicillin/clavulanate (Clavulin), 875 mg PO bid for 7–10 days

or

clindamycin (Dalacin) 300–450 mg PO qid for 7 days

Monitoring and Follow-Up

Arrange follow-up within 48 hours for reassessment or before if worsening symptoms or shortness of breath develops and follow-up again after the course of antibiotics is completed.

Referral

Usually not necessary for patients with mild to moderate symptoms unless their condition is worsening, complications occur or they have significant comorbid conditions.

MANAGEMENT OF SEVERE PNEUMONIA**Appropriate Consultation**

Consult a physician for any client with severe symptoms (for example, appears acutely ill or has hemoptysis, significant respiratory distress or a significant comorbid condition such as COPD, diabetes mellitus, heart disease, renal disease or cancer) or for any client who has not responded to initial oral treatment and whose condition is worsening.

Adjuvant Therapy

- Oxygen via non-rebreather mask; titrate flow to keep oxygen saturation > 97% to 98%
- For COPD clients, provide oxygen at 4–6 L/min via 24% Venturi mask; titrate flow and mask concentration to keep saturations at 90% to 92%
- Watch for signs of respiratory depression
- Start IV therapy with normal saline; adjust the rate to maintain hydration

Pharmacologic Interventions

Discuss with a physician. IV antibiotic of choice:

ceftriaxone (Rocephin), 1–2 g IV q24h

Monitoring and Follow-Up

Monitor oxygen saturation (with pulse oximeter, if available) and vital signs closely.

Referral

Medevac to hospital.

EMERGENCIES OF THE RESPIRATORY SYSTEM

PNEUMOTHORAX

Pneumothorax is partial or complete collapse of a lung because of the presence of air in the pleural space.

There are 2 categories: spontaneous and traumatic.

There are 3 mechanisms: closed, open and tension.

Closed pneumothorax: Air from the lung itself leaks into the pleural space through a tear in the lung tissue (for example, when a fractured rib end tears the lung), causing the lung to collapse.

Open pneumothorax (a sucking chest wound): Air from the outside enters the pleural space through a hole in the chest wall (such as a knife wound), causing the lung to collapse.

Tension pneumothorax: This is a special form of closed pneumothorax, and it is life threatening. Air is trapped under pressure in the pleural space. It collapses the lung, then pushes on the heart and the opposite lung.

If the pressure is not quickly released, the client will become hypotensive and die.

CAUSES

- Perforation of the visceral pleura and entry of air from the lung
- Penetration of the chest wall, diaphragm, mediastinum or esophagus

Risk Factors

- Idiopathic (cause unknown, a spontaneous occurrence seen more often in persons that are tall and thin, male, smoker)
- Chronic obstructive pulmonary disease (COPD) (rupture of an emphysematous bulla or bleb)
- Tuberculosis (TB)
- Cystic fibrosis
- Asthma
- Lung neoplasm
- Flying
- Diving
- Spontaneous vigorous exercise
- Smoking
- Penetrating chest trauma (for example, knife or gunshot wound)
- Blunt chest trauma (for example, rib fracture)

HISTORY

- Recent trauma
- Known COPD
- Young, tall, healthy male, 20–40 years of age (idiopathic)
- Smoking
- Sudden onset of one-sided chest or shoulder pain
- Shortness of breath
- Symptoms may develop more slowly if the collapse is gradual and the person is able to partially compensate

PHYSICAL FINDINGS

Physical findings vary, depending on the extent of the lung tissue that has collapsed and the mechanism of the pneumothorax.

- Tachycardia
- Tachypnea, dyspnea
- Blood pressure variable: normal to hypotensive
- Mild to severe respiratory distress, oxygen saturation decreased
- Cyanosis (late feature of hypoxia)
- Movement of air may be felt over an open chest wound
- Decreased tactile/vocal fremitus
- Hyperresonance (hollow) over the pneumothorax
- Breath sound/air entry decreased or absent over the pneumothorax

The trachea deviates *toward* the side of an open or a closed pneumothorax, but *away from* the side of a tension pneumothorax; the mediastinum (apex of the heart) shifts in the same direction as the trachea.

DIFFERENTIAL DIAGNOSIS

- Pleurisy
- Pericarditis
- Pulmonary embolism
- Myocardial infarction
- Dissecting aneurysm
- Diaphragmatic hernia

DIAGNOSTIC TESTS

- Chest x-ray (if available) standing if possible, to see air at apex of lung

MANAGEMENT**Goals of Treatment**

- Immediately relieve pressure in the pleural space (tension pneumothorax)
- Improve oxygenation
- Re-expand the collapsed lung

Appropriate Consultation

Consult a physician as soon as possible.

Adjuvant Therapy

- Oxygen via non-rebreather mask; titrate flow to keep oxygen saturation > 97% to 98%
- Ventilatory assistance as needed with Ambu bag or mask
- Start intravenous (IV) therapy with normal saline to keep the vein open; if there has been trauma, start 2 IVs. Angiocath size 18 gauge or larger. Replace any lost blood (*see “Shock” in the General Emergencies and Major Trauma Chapter*).

Nonpharmacologic Interventions**Tension Pneumothorax**

This condition is life threatening. The pressure build-up must be released immediately by needle decompression.

Locate the puncture site.

1. Locate the 2nd intercostal space in the midclavicular line on the side of the pneumothorax. (Nerve bundles and blood vessels are located under the ribs and puncturing them could cause nerve damage and extensive bleeding. Ensure that the puncture is being made over the top of the 3rd rib.)
2. Cleanse the site with povidone-iodine (Betadine) and maintain as much of a sterile field as possible.
3. Insert a 14-gauge angiocatheter, puncturing the skin perpendicularly, just superior to the 3rd rib (in the 2nd intercostal space). Direct the needle just over the 3rd rib and into the thoracic cavity. A “pop” should be felt as well as a “rush of air.”

4. Advance the catheter while removing the needle.
5. Secure angiocatheter in place; attach to flutter valve if one is available.
6. Secure the catheter in the chest wall with a dressing and tape.
7. Monitor the patient **closely** and continue to reassess.

An alternate site recommended is the 4th or 5th intercostal space in the anterior axillary line on the same side as the pneumothorax.

Open Pneumothorax

- Cover the hole in the chest with loose sterile gauze taped on three sides
- If a foreign body (for example, a knife) is protruding from the chest wall, *do not remove it*; stabilize it and leave it in place as the blade may be tamponading further bleeding

Monitoring and Follow-Up

- Place client on bed rest
- Monitor ABCs (airway, breathing, circulation) and lung sounds frequently
- Vital signs put on continuous O₂ sat and cardiac monitor (if available)

Referral

Medevac as soon as possible. Ideally a chest tube should be inserted by a physician or other trained personnel and connected to drainage system under suction before the client is transported, especially if transport is via aircraft.

ACUTE FOREIGN-BODY OBSTRUCTION OF AN AIRWAY

Complete or partial blockage of the airway with a foreign body.

CAUSES

Aspiration (due to eating too quickly, eating and talking at the same time, neurological disorders, motility disorders of the esophagus).

HISTORY AND PHYSICAL FINDINGS

Partial Airway Obstruction

- Clear history of sudden aspiration
- Symptoms of respiratory distress
- Air entry variable, ranging from adequate to poor
- With poor air entry, client has limited ability to breathe, talk and cough; cough is weak and ineffective; severe respiratory distress is present
- With adequate air entry the client can cough forcefully, talk and breathe; frequently there is wheezing between coughs; severe respiratory distress is not present

Complete Airway Obstruction

- Client unable to speak or breathe
- Severe respiratory distress
- The hands are usually put around the throat in a classic universal sign of choking
- Loss of consciousness will occur if the obstruction is not quickly relieved
- The victim may be unconscious
- Cyanosis

DIFFERENTIAL DIAGNOSIS

- Anaphylaxis with laryngeal edema (acute allergy)
- Airway trauma
- Acute asthmatic attack
- Epiglottitis
- Bacterial tracheitis
- Any condition that can cause sudden respiratory failure (for example, stroke, epilepsy, myocardial infarction, drug overdose)

COMPLICATIONS

- Retention of fragment of foreign material
- Fracture of ribs or internal injury as a result of abdominal thrusts
- Decompensation of pre-existing medical conditions
- Death

MANAGEMENT

Goals of Treatment

- Dislodge and remove the foreign body
- Improve oxygenation (assess and maintain patency of airway)

Nonpharmacologic Interventions

- Perform abdominal thrusts or chest thrusts to dislodge foreign body
- Do not use abdominal thrusts when the person is able to cough forcefully, breathe and speak (which indicates partial obstruction with adequate air entry); allow the person to clear his or her own airway with spontaneous coughing and breathing

Adjuvant Therapy

- Assist ventilation as necessary with Ambu bag or mask once the obstruction has been removed
- Administer oxygen as necessary once the obstruction has been removed
- Start IV therapy with normal saline to keep vein open if client shows evidence of continuing respiratory distress
- If severe distress, put on cardiac monitor (if available) in case of arrest

Monitoring and Follow-Up

Monitor the client for development of respiratory distress (which may indicate retention of fragment of the foreign body).

Appropriate Consultation

Consult a physician as soon as possible if the client shows evidence of continuing respiratory distress (which may indicate retention of fragment of the foreign body).

Referral

Medevac as required for further investigation and management of continuing respiratory distress.

PULMONARY EMBOLISM

Lodging of a blood clot in the pulmonary arterial tree with subsequent increase in pulmonary vascular resistance and possible obstruction of blood supply to the lung parenchyma.

CAUSES

- Blood clot embolizing from deep pelvic or leg veins
- Fat embolus (related to fractured femur or pelvis), air embolus

Risk Factors

- Prolonged bed rest
- Prolonged air flight or automobile ride may be a predisposing factor
- Immobilization of a limb after trauma
- Recent surgery
- Chronic venous insufficiency
- Advanced age
- Obesity
- Stroke
- Pregnancy
- Congestive heart failure
- Oral contraceptives/HRT
- Underlying malignant disease (particularly adenocarcinoma)
- Cancer treatment (chemotherapy, hormonal)

HISTORY

Symptoms vary greatly in severity. Pulmonary embolus may present as three different syndromes.

Acute cor pulmonale (right-sided heart failure) is due to massive embolus obstructing 60% to 75% of the pulmonary circulation.

Pulmonary infarction occurs in patients with massive embolism and complete obstruction of a distal branch of the pulmonary circulation.

Acute unexplained shortness of breath occurs in patients who do not have cor pulmonale or infarction.

- Sudden onset of shortness of breath (may be the only symptom)
- Pleuritic chest pain with infarction
- Cough (rare)
- Hemoptysis may be present in infarction
- Syncope (faintness) may be present in cor pulmonale
- Leg pain (infrequent), swelling, redness or pale
- Anxiety

Older clients may present with increasing shortness of breath, confusion and restlessness (which indicate hypoxia).

PHYSICAL FINDINGS

The physical findings, like the history, are variable. The results of the examination can be deceptively normal or obviously abnormal. Consider pulmonary embolism in any person with unexplained dyspnea.

- Resting heart rate elevated
- Respiratory rate elevated
- Blood pressure normal, elevated or low (cor pulmonale)
- Mild-to-severe respiratory distress, oxygen saturation decreased
- Anxiety
- Sweating, pallor and cyanosis may be present
- Distension of neck veins with cor pulmonale
- Peripheral edema may be present with cor pulmonale
- Swelling, redness of calf infrequently present
- Calf tenderness may be present, measure calf
- Peripheral pitting edema may be present
- Dullness to percussion may be present (with infarction and if associated with pleural effusion)
- Air entry may be reduced in affected area
- Crackles and wheezes may be present (with infarction)
- S₃ (gallop rhythm) may be present with cor pulmonale
- Loud second heart sound may be present

DIFFERENTIAL DIAGNOSIS

- Acute congestive heart failure
- Myocardial infarction
- Pneumonia
- Viral pleuritis
- Pericarditis

COMPLICATIONS

- Pulmonary infarction
- Cor pulmonale (right heart failure)
- Left heart failure with pulmonary edema
- Recurrent emboli
- Death

DIAGNOSTIC TESTS

- Electrocardiography; results are often normal, except for resting tachycardia (not explained by fever, dehydration) but can help rule out myocardial ischemia
- Chest x-ray (frequently normal) possibly small pleural effusions, atelectasis, elevation of a hemidiaphragm

MANAGEMENT**Goals of Treatment**

- Prevent death
- Dissolve embolus
- Prevent recurrent embolization

Appropriate Consultation

Consult a physician as soon as possible.

Adjuvant Therapy

- Oxygen via non-rebreather mask; keep oxygen saturation > 97% to 98%
- Start IV therapy with normal saline; adjust rate according to state of hydration
- If hypotension is present, resuscitate with appropriate fluid volumes (*see “Shock” in the chapter “General Emergencies and Major Trauma”*)

Nonpharmacologic Interventions

Bed rest.

Pharmacologic Interventions

Consult a physician regarding initial anticoagulation with a therapeutic dose of low molecular weight heparin.

enoxaparin (Lovenox) 1 mg per kg (about 0.5 mg per pound) twice daily or 1.5 mg per kg (about 0.8 mg per pound) once daily SC for existing clots

Administration should be alternated between the left and right front abdominal wall, towards the sides.

The dose of enoxaparin is reduced for patients with severe impairment of kidney function.

Medications that increase the risk of bleeding will add to the effects of enoxaparin and further increase the risk of bleeding that is associated with enoxaparin. Such medications include aspirin, clopidogrel (Plavix) and the nonsteroidal anti-inflammatory drugs such as ibuprofen (Motrin, Advil), naproxen (Naprosyn), diclofenac (Voltaren) and others.

Pregnancy

Enoxaparin does not cross the placenta and shows no evidence of effects on the fetus. It often is used during pregnancy as an alternative to oral anticoagulants such as warfarin (Coumadin), which cannot be safely used during pregnancy.

Nursing Mothers

Sparse data is available regarding the effects of enoxaparin during lactation. However because of its relatively high molecular weight and inactivation in the GI tract, its transfer into breast milk and risk to a breastfed infant should be considered negligible.⁹

Monitoring and Follow-Up

- Monitor ABC and vital signs frequently if abnormal
- Assess lung sounds periodically for signs of cardiac failure
- Consult physician regarding drawing CBC and baseline INR (possibly type and screen) before starting anticoagulation

Referral

Medevac as soon as possible.

If the client has evidence of pulmonary edema, *see “Pulmonary Edema” in Chapter 4, “Cardiovascular System”*.

INHALATION OF TOXIC MATERIALS

Inhalation of gases, fumes or particulate matter.

CAUSES

- Household fires
- Leaky vehicle muffler
- Suicide attempt
- Chemical exposure in the work place
- Agents: carbon monoxide, carbon dioxide, toxic gases, toxic byproducts from the burning of plastics, propane, solvents, gasoline, glue, keyboard cleaner, air freshener, hand sanitizer

HISTORY

- Exposure to any of the agents listed above
- Cough and sputum (which may be black)
- Shortness of breath
- Sore throat, hoarseness
- Altered or loss of consciousness or confusion before admission

PHYSICAL FINDINGS

- Heart rate elevated
- May lead to cardiac arrhythmias
- Respiratory rate increased
- Blood pressure may be elevated or hypotensive
- Oxygen saturation with pulse oximeter is not accurate for carbon monoxide poisoning
- Level of consciousness variable
- Degree of respiratory distress variable
- Facial burns, singed eyebrows and nasal hair
- Soot around or in the nose
- Mucosal irritation or thermal injury of the mouth with erythema and carbon deposits (soot)
- Other cutaneous burns
- Irritation of the mucous membranes (eyes)
- Air entry may be reduced
- Wheezes may be present
- Stridor or wheeze may be heard
- A flushed face and rosy red cheeks are characteristic of carbon monoxide poisoning

DIFFERENTIAL DIAGNOSIS

- Drug overdose
- Alcohol intoxication

COMPLICATIONS

- Bronchospasm
- Pulmonary edema
- Acute laryngeal edema
- Obstruction of the upper airway
- Deterioration of pre-existing heart or lung disease
- Arrhythmias and death

DIAGNOSTIC TESTS

- Chest x-ray (if available), but only if you think it will alter your decision to transfer care to hospital

MANAGEMENT**Goals of Treatment**

- Improve oxygenation, protect and maintain airway
- Identify associated injuries to underlying lung

May initially look stable, but could deteriorate if airway injury (for example, smoke inhalation later causes edema and inflammation, then airway no longer patent and may need intubation)

Appropriate Consultation

Consult a physician as soon as possible.

Adjuvant Therapy

- Oxygen via non-rebreather mask; titrate flow to keep oxygen saturation > 97% to 98%
- Higher-flow oxygen is needed for carbon monoxide poisoning – consult physician
- Start IV therapy with normal saline; adjust the rate according to the state of hydration
- Cardiac monitor if available

Pharmacologic Interventions

Bronchospasm is treated with inhaled salbutamol (Ventolin). (*See sections on management of chronic asthma and mild, moderate and severe asthma exacerbations.*)

Monitoring and Follow-Up

Monitor ABC and lung sounds closely. If patient deteriorating, may require assisted ventilation with Ambu bag, intubation or rescue airway.

Referral

Medevac as soon as possible.

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