

## CHAPTER 3

# Respiratory Issues

### ANATOMIC POINTERS

The respiratory system is primarily responsible for gas exchange through ventilation and diffusion. Working in concert with the cardiovascular system, which is responsible for perfusion (supplying blood to organ tissues), the respiratory system provides body cells with oxygen ( $O_2$ ) to generate energy and eliminates carbon dioxide ( $CO_2$ ), a waste product of cellular metabolism. This gas exchange occurs between the alveoli, the lung's microscopic air sacs, and the capillaries surrounding the alveoli. The gas concentration differences in the alveoli and blood provide a diffusion gradient across the alveolar-capillary membrane, which drives  $O_2$  in and  $CO_2$  out of the lungs.

The upper respiratory tract comprises mainly the nose, sinuses, nasal passage, pharynx, tonsils, epiglottis, adenoids (lymphoid tissues), larynx, and trachea. The lower respiratory tract consists of the lungs, which contain the bronchi, bronchioles, and alveoli.

The pharynx (the throat) is divided into three regions: the nasopharynx, which serves as a passageway for air only, and the oropharynx and the laryngopharynx, which function as a passageway for both air and food. The nasopharynx is connected to the middle ear by the auditory eustachian tubes, the obstruction of which often results in otitis media.

The larynx is also called the voice box. When an individual swallows, the epiglottis covers the entrance of the larynx

to prevent food or liquid from entering the lungs. Normally, if anything other than air enters the larynx, a cough reflex is triggered that expels the substance. Because this protective reflex does not occur in an unconscious individual, aspiration is more likely to occur in such a patient.

The trachea (the windpipe) divides into the right and left primary bronchi, which further divide several times into smaller segments, the respiratory bronchioles and the terminal bronchioles. The right bronchus is shorter, wider, and straighter than the left bronchus. As a consequence, a foreign substance is more likely to enter the right bronchus, affecting the right lung.

The lungs are enveloped by the pleurae, which consist of a visceral layer and a parietal layer. Irritation of the parietal pleura will cause pain because of the sensory pain fibers in this layer. A small amount of lubricating fluid is found in between the two layers of the pleural space.

The right lung has three lobes; the left lung has two lobes. The lungs contain millions of alveoli, which collectively provide an enormous surface on which gas exchange can occur. The alveoli also produce surfactant, which reduces surface tension and facilitates alveolar expansion.

### DISORDERS AND CONDITIONS

#### ACUTE RESPIRATORY DISTRESS SYNDROME

Acute respiratory distress syndrome (ARDS), often characterized by pulmonary edema, may result from direct or indirect insult to the lungs. Subsequently, increased membrane permeability causes fluid to accumulate in the lungs, affecting gas exchange owing to both the nonfunctional alveoli and the non-compliance (stiffening) of the lungs. Most patients with ARDS develop progressive hypoxemia (insufficient blood oxygenation) that is unresponsive to additional oxygen administration, which can in turn lead to acute respiratory failure.

Predisposing factors for developing ARDS vary widely, from fluid overload, drug overdose, smoke inhalation, gastric content aspiration, sepsis, shock, and serious trauma to pulmonary embolism.

### Main Symptoms

Manifestations of ARDS may occur within hours or days of direct or indirect lung injury, including the following symptoms:

- Restlessness and decreased level of consciousness
- Dyspnea (difficulty breathing), tachypnea (increased respiration rate), and crackles (hissing sounds) auscultated over the lung fields
- Hypoxemia (with falling  $\text{PaO}_2$  [partial pressure of oxygen] level), unresponsive to additional  $\text{O}_2$  administration, and hypercapnia (increased serum carbon dioxide), in which  $\text{O}_2$  is unable to cross the membrane of the alveoli as usual

If not corrected, respiratory distress may quickly become life threatening, resulting in a fatal event such as ventricular fibrillation.

### Selected Nursing Tips

1. Identify at-risk patients and take preventive measures. Be alert to patients' early signs of hypoxemia, such as changes in level of consciousness and increased restlessness.
2. Treat underlying causes; prevent progression and complications of ARDS. Support ventilation with appropriate means, and reduce anxiety to decrease oxygen consumption. Monitor arterial blood gas (ABG) and lab values and prevent potential respiratory acidosis or increased  $\text{PaCO}_2$  (partial pressure of carbon dioxide). Maintain blood pressure; correct fluid and electrolyte imbalances to prevent dysrhythmia.
3. Prevention and early recognition of multiple-organ dysfunction or failure are essential.

4. Proper positioning of the patient can facilitate postural draining and mobilize secretions; placing the patient in an upright position, if possible, may promote lung expansion. (Ask close-ended questions that can be answered with “yes” or “no” to reduce oxygen expenditure and difficulty breathing.)
5. Mechanical ventilation with positive end-expiratory pressure (PEEP) may help patients with ARDS avoid end-expiratory alveolar collapse and improve oxygenation in conjunction with treatment of the causative conditions. Assess the patient’s oxygen saturation rate and respiratory status after placing the patient on a ventilator.
6. To minimize risks for developing ARDS, maintain patients’ fluid balance to prevent fluid overload; provide adequate fluid replacement to patients experiencing hypovolemia (decreased blood volume).

### **Point to Consider**

If a patient who has recently sustained smoke or chemical inhalation exhibits severe hypoxia (deficient oxygen supply to the tissues due to inadequate oxygenation), along with diaphoresis and dyspnea, the onset of ARDS may be suspected. Near-drowning (in which the lungs become filled with fluid) may potentially cause ARDS.

### **Precautions**

1. Monitor the patient’s vital signs and lab results closely; this condition could deteriorate quickly, and arrhythmia (irregular heart beat) may result from factors such as hypoxemia (decreased serum oxygen concentration), acidosis, and electrolyte imbalance. A variety of treatment approaches and technologies may need to be employed as ordered, including oxygen administration or mechanical ventilation.
2. A change in level of consciousness can indicate insufficient oxygen supply to the brain. Cyanosis is frequently a late sign of respiratory distress.

## ASTHMA

Asthma often results from the airway becoming overresponsive or hypersensitive to various stimuli, which in turn leads to episodic bronchial spasms and constriction. This condition is recurrent and usually reversible. It is characterized with inflammation and airflow limitation. The patient with asthma may develop mucosal edema, profuse mucus production, and difficulty breathing. Episodes are often triggered by specific allergens to which the patient is sensitive (e.g., pollen, medications, food additives) or provoked by certain conditions that cause bronchial spasm (e.g., exercise in extreme temperature).

In status asthmaticus, the patient experiences a prolonged asthma attack that does not respond to initial or conventional treatment. Status asthmaticus has the potential to cause respiratory failure, which may be indicated by an absence of wheezing in a patient who has been wheezing and visibly uncomfortable with inaudible breath sounds and ineffective cough.

### Main Symptoms

- Inspiratory and expiratory wheezes, often audible
- Shortness of breath, increased pulse, and perspiration
- Productive cough
- Chest tightness resulting from reduced movement of air through narrowed bronchial airways

The onset of status asthmaticus is often accompanied by confusion, diaphoresis, lethargy, and cyanosis.

### Selected Nursing Tips

1. Assess patients' respiratory status and manage their symptoms; obtain a health history to identify precipitating factors, including allergens or environmental irritants. Nursing management also includes patient education and prevention of exacerbations.
2. When patients with asthma are having difficulty breathing and wheezing, the nurse may sit them up and administer

breathing treatment as ordered (often a bronchodilator) with either an inhaler or a nebulizer. Wheezing occurs as air moves through airways that have become narrowed due to bronchospasm and increased mucus production. The nurse may also administer oxygen as indicated.

3. Patients with asthma or chronic obstructive pulmonary disease (COPD) are often prescribed two metered-dose inhalers (MDIs), containing a bronchodilator and a steroid, respectively. Using a bronchodilator inhaler containing albuterol (Proventil) first may help open up the airway, thereby facilitating more effective delivery of the second (steroid) medication to the lungs. Steroid inhalation is used primarily to reduce bronchial inflammation and mucus secretions.
4. Inhaled steroids, such as beclomethasone (an anti-inflammatory immunosuppressant agent), for asthma can suppress the normal flora (beneficial organisms) in the mouth, giving rise to oral candidiasis (yeast infection). Teach and have the patient demonstrate how to use an inhaler with a spacer. Advise the patient to rinse the mouth immediately after each use to prevent dry mouth and thrush, which may appear as a cheesy white patch on the tongue or throat. Monitor the patient's respiratory status for signs of sore throat. Patients should strictly adhere to the prescribed dose schedule. When discontinuing a steroid medication, it must be tapered off as ordered.
5. Counsel patients to remove or avoid asthma triggers, which may vary for specific individuals, but often include certain foods, pollen, mold, dust, cold air, irritating odors, and smoke.
6. Follow the treatment protocol and manage status asthmaticus so as to avoid intubation. Use other treatment options to correct hypoxia and improve ventilation, including administering medications and supplemental oxygen as ordered to reduce bronchospasm and improve patients' general oxygenation.

**Points to Consider**

1. Albuterol (Proventil, Ventolin) and levalbuterol (Xopenex) are bronchodilators. The therapeutic effects of these adrenergic agonists include relieving bronchial muscle spasm by relaxing the smooth muscle and reducing airway resistance.
2. Ipratropium (Atrovent), an anticholinergic agent, causes bronchodilation and inhibits nasal secretion production. It is not indicated for immediate bronchospasm relief. This medication is often used together with albuterol (a bronchodilator) in the form of Combivent or DuoNeb for nebulizer-treatment use, as albuterol relieves bronchospasm. Follow the guidelines for proper inhaler use; make sure the patient does not take more than two inhalations concurrently, which can negate the broncho-dilating effect.
3. Severe asthma attack may cause respiratory acidosis with increased arterial partial pressure of carbon dioxide ( $\text{PaCO}_2$ ), decreased partial pressure of oxygen ( $\text{PaO}_2$ ), and decreased pH (acidosis) due to fatigue-induced alveolar hypoventilation.

**Precaution**

Cessation of wheezing breath sounds in a patient with status asthmaticus may indicate an impending respiratory obstruction. Carefully evaluate the patient with status asthmaticus to avoid misinterpreting the reduction in wheezing as an improvement of the patient's condition.

**ATELECTASIS**

Atelectasis, or incomplete expansion or collapse of the lung alveoli, may result from decreased breathing or reduced alveolar ventilation. Its risk factors and causes include altered breathing patterns (e.g., shallow breathing due to pain), secretion retention, immobility, increased abdominal pressure, and airway function alterations. Because gas exchange occurs in the alveolar membranes, impaired lung expansion leads to a reduction in

the surface area available for gas exchange, subsequently causing hypoxia.

## Main Symptoms

- Dyspnea to different degrees depending on the underlying cause, the extent of compromised condition, and the severity of hypoxia
- Diminished or absent lung sounds on the affected areas
- Anxiety
- Tachycardia and cyanosis

## Selected Nursing Tips

1. Identify the risk factors in patients with compromised respiratory status and take steps to improve breathing effectiveness.
2. A simple and effective way to optimize patients' respiration and prevent atelectasis is to have them breathe deeply and cough at times to maintain an open airway. If coughing causes pain at an incision site, teach the postoperative patient to splint the incision with a pillow before coughing. Patients tend to cooperate when pain is alleviated with adequate analgesics.
3. Frequent repositioning and assisting early ambulation may help prevent atelectasis in at-risk patients. Elevating the head and chest properly may promote airway clearance and lung expansion.
4. Using incentive (spirometry) breathing may help patients with certain acute conditions, such as after surgery or having a fractured rib, to breathe deeply on a regular basis to prevent pulmonary complications. Ambulating is encouraged but cannot be done as conveniently and frequently as using the spirometry.
5. Encourage fluid intake, as appropriate, and humidify the inhaled air to loosen and mobilize secretions.



**Points to Consider**

1. Deep breathing allows the diaphragm to descend, expanding the ventilating surface and thereby reducing the patient's risk of developing atelectasis.
2. Chest percussion, postural drainage, and incentive spirometry may be utilized in addition to medication, if prescribed. Suction as needed, especially if the patient is intubated. Auscultate lung sounds to determine if suction is needed; obtain the patient's vital signs, and provide oxygenation before the procedure.
3. Severe or massive atelectasis may result in acute respiratory distress, especially in patients with coexisting pulmonary diseases. Other respiratory-care measures may be employed by practitioners as indicated for severe cases, including endotracheal intubation and mechanical ventilation. The underlying causes of atelectasis must always be addressed or removed.
4. For most patients, a pulse oximetry reading provides information about the percentage of oxygenated (oxygen-carrying) hemoglobin. For instance, an arterial  $O_2$  saturation level of 97% usually indicates that 97% of the total hemoglobin attachments for  $O_2$  are oxygen saturated. However, the readings are less accurate with  $O_2$  saturations below 75% and unreliable with poor peripheral perfusion.

**Precautions**

1. Sedatives will depress breathing and the cough reflex; they should be administered with discretion per the physician's orders.
2. Be vigilant for signs of severe atelectasis, such as dyspnea or hypoxia. These conditions may be indicated by low  $O_2$  saturation rate, which can be easily monitored via pulse oximetry.

**CHRONIC OBSTRUCTIVE PULMONARY DISEASE**

Chronic obstructive pulmonary disease (COPD) usually includes a chronic inflammation (abnormal inflammatory response) component as well as progressive airflow limitation.

The classification of diseases subsumed under the COPD heading has been changing over the years as results emerge from ongoing research. Discussed in this section (extremely briefly) are chronic bronchitis and emphysema.

Even though COPD cannot be fully reversed, it is treatable. In fact, this condition is often preventable, as it is frequently related to exposure to smoke or environmental pollutants. It is common for bronchitis, emphysema, and asthma to coexist in patients with COPD, with their symptoms overlapping.

**Main Symptoms**

Clinical features of chronic bronchitis may include the following symptoms:

- Productive cough, excessive mucus secretion, decreased airway clearance due to airway inflammation, and increased susceptibility to respiratory infection
- Activity intolerance and exertional dyspnea
- Edema, weight gain, and cyanosis

In patients with emphysema, impaired gas exchange often results from damage to the alveolar walls, which causes decreased elastic recoil and reduces the surface area available for gas exchange. Exhalation may become difficult, resulting in air trapping and hypoxia. Manifestations of these developments may include the following signs and symptoms:

- Dyspnea and barrel chest
- Anorexia, thin appearance, and malaise
- Having a sense of air hunger, using accessory muscles to breathe through pursed lips, and often assuming a tripod position—that is, sitting with arms supported on a table

In later stages, hypoxemia may be further worsened, and hypercapnia and respiratory acidosis may occur. Peripheral edema and pulmonary congestion may indicate the cardiac involvement.

Patients with advanced COPD (especially emphysema) are typically barrel-chested (with hyper-inflated chest and flattened diaphragm on chest X-ray) owing to the incomplete CO<sub>2</sub> elimination associated with this condition. The neck muscles may be overly developed and the neck veins distended.

Both chronic bronchitis and emphysema may have some characteristics in common:

- Possible productive cough
- Dyspnea on exertion, progressing to dyspnea at rest
- Diminished breath sounds, use of accessory muscles to breathe, and airflow limitations

### **Selected Nursing Tips**

1. Provide low-dose oxygen as needed. It is very important that patients with COPD not receive high-dose oxygen, as this treatment may reduce or stop their own drive to breathe, necessitating the use of an Ambu (resuscitation) bag to ventilate the patient. (Note that there are other theories regarding the underlying causes of this condition.)
2. Encourage patients with chronic bronchitis to increase their fluid intake, if not contraindicated. Ensuring adequate hydration may help mobilize secretions for expectoration and replace fluid loss from pathologies such as fever or other causes.
3. Teach patients to employ diaphragmatic/abdominal breathing, which relieves the accessory muscles of much of the work of respiration and improves ventilation.
4. Coarse crackles, rhonchi (snoring sound heard during auscultation), and wheezes are abnormal lung sounds associated with exacerbations of COPD. They often occur

secondary to respiratory infection, as air passes through a secretion-obstructed narrowing airway.

5. If a patient with COPD becomes restless due to dyspnea, initial nursing actions usually include starting low-dose oxygen administration and assisting the patient to sit up, if possible, to facilitate breathing. Monitor the patient's oxygenation status with a pulse oximeter.
6. Patients with COPD are highly recommended to obtain the influenza and pneumococcal vaccinations, per protocol, as preventive measures. The accumulation of respiratory secretions due to ineffective airway clearance in these patients is the main risk factor for pulmonary infection.
7. Encourage patients to adopt healthy habits and participate in regular aerobic exercise, which promotes cardiac fitness and increases activity tolerance. Teach patients how to recognize the symptoms of respiratory infection and potential complications of COPD.

### Points to Consider

1. Persuade patients to stop smoking, even though it is a hard habit to break. If smoking cessation is successful, it will be a cost-effective way to prevent the development or halt the progression of COPD. Use of tobacco can affect the airway-cleansing mechanism and increase mucus accumulation, causing more irritation to the lungs. In addition, one of the by-products of smoking is carbon monoxide, which renders hemoglobin incapable of carrying oxygen. (Carbon monoxide from cigarette smoking can saturate the body's hemoglobin, which makes pulse oximetry  $O_2$  saturation values inaccurate in patients who are smokers.) Secondhand smoke can also contribute to the development of COPD.
2. Some over-the-counter medications may thicken bronchial secretions, like antihistamines such as diphenhydramine (Benadryl). Patients with COPD should use these medications with caution.

3. Pursed-lip breathing (or whistling while exhaling) is a beneficial form of exercise for patients with COPD, as it promotes relaxation and keeps the bronchi open, allowing more effective exhalation of the carbon dioxide trapped in the alveoli.
4. Rust-colored sputum from a patient with COPD may indicate blood in the sputum and require further assessment to rule out pneumonia or other complications.
5. Right-sided heart failure may result from COPD because of the development of pulmonary hypertension. Typical signs to be monitored include peripheral edema and jugular vein distension, among others.
6. Polycythemia (excessive production of red blood cells) may occur secondary to COPD as a result of the body's compensatory response to chronic hypoxia; higher-than-normal blood viscosity increases risk of thrombosis.

### **Precaution**

Oxygen administered at a rate exceeding 2-3 L/m may depress or eliminate the hypoxic respiratory drive in patients with COPD. One theory explains this effect by proposing that the breathing drive in patients with COPD is linked to a low blood O<sub>2</sub> level (hypoxia), whereas a high CO<sub>2</sub> level stimulates the respiratory center in the medulla of people with healthy lungs to breathe.

### **COR PULMONALE**

In cor pulmonale, the right ventricle of the heart is enlarged (hypertrophic). This condition often emerges secondary to pulmonary disorders affecting the right side of the heart, such as COPD with pulmonary hypertension, resulting in right-sided heart failure. Lung disorders that cause hypoxemia, resulting in pulmonary blood-vessel constriction and vascular-bed reduction, may potentially lead to cor pulmonale. Cor pulmonale often occurs late in the course of irreversible lung diseases with a poor prognosis.

## Main Symptoms

Patients with cor pulmonale may or may not exhibit signs of heart failure when the heart can compensate for the increased pulmonary vascular resistance. Clinical manifestations often reflect underlying disorder, and consist of mostly respiratory symptoms:

- Chronic productive cough
- Exertional dyspnea and wheezing
- Fatigue and weakness

When right-sided heart failure develops in cor pulmonale, patients may present with the following symptoms:

- Resting dyspnea, tachypnea, and orthopnea (labored breathing while lying flat)
- Weight gain, dependent edema, distended neck veins, and signs of right-sided heart failure
- A weak pulse, reflecting decreased cardiac output

## Selected Nursing Tips

1. Manage cor pulmonale by reducing hypoxemia, increasing activity tolerance, and treating pulmonary problems that would induce heart failure.
2. Provide small and frequent meals, as patients with cor pulmonale tire easily. Fluid and salt restriction, if so ordered, may reduce fluid retention.
3. Provide oxygen therapy and teach pursed-lip breathing; suggest bed rest to decrease oxygen demand as indicated.
4. If the patient is receiving diuretics, such as potassium-depleting furosemide (Lasix) and potassium-sparing spironolactone (Aldactone), monitor serum electrolytes closely, especially potassium levels. Either hyperkalemia or hypokalemia can cause a dangerous cardiac arrhythmia.
5. Emphasize the importance of adhering to the treatment regimen.

**Point to Consider**

Provide teaching about the need for lifestyle modifications, including adequate rest, weighing oneself daily, and reporting signs of edema, weight gain, or respiratory infection such as an increased amount of sputum, fever, or wheezing.

**Precaution**

Monitor the patient's oxygenation status and arterial blood gas levels. Watch for signs of respiratory failure, such as restlessness, confusion, low oxygen saturation rate, and labored breathing.

**CYSTIC FIBROSIS**

Cystic fibrosis (CF), a genetic disorder, is characterized by dysfunction of the exocrine glands, which causes secretions to be thick and sweat high in salt content. The functions of multiple organs can be affected, including the lungs, sweat glands, intestines, liver, and pancreas. Patients may develop bronchial mucus plugging, inflammation, and potentially bronchiectasis, progressively losing lung function. Cysts may occur in the lungs, and some portion of the glands may become fibrotic and scarred.

**Main Symptoms**

- Profuse thick, sticky respiratory secretions; impaired airway clearance; and inflammation
- Fibrotic/pathologic changes in the pancreas, resulting in reduced pancreatic enzymes and malabsorption of fat and protein, leading to other gastrointestinal (GI) problems
- Steatorrhea (bulky fatty stools) because of undigested fats
- Salty sweat (containing increased sodium and chloride) due to sweat gland dysfunction, potentially causing hyponatremia and hypochloremia

Patients with CF are often malnourished. In addition, they are predisposed to electrolyte imbalances and respiratory complications.

### **Selected Nursing Tips**

1. Support the patient and family throughout the disease process in an interdisciplinary therapy approach; address end-of-life concerns as warranted.
2. Encourage consumption of a diet low in fat, but high in protein and calories. Provide necessary supplementation of fat-soluble vitamins (A, D, E, and K) and added salt as prescribed or recommended.
3. Educate patients that taking pancreatic enzymes as ordered (with a generous amount of liquid) can aid the absorption of the nutrients in the meals and snacks ingested.
4. Arrange for prescribed chest physiotherapy, such as postural drainage, chest percussion, vibration (or vibrating vests treatment), and breathing exercises to promote removal of secretions from the lungs.
5. Increasing fluid intake, as appropriate, can help dilute secretions and facilitate expectoration. Monitor for signs of complications and prevent respiratory infection.

### **Point to Consider**

Recommend the use of humidifiers to decrease the patient's susceptibility to respiratory infection, as appropriate.

Teach proper maintenance of the humidifier to prevent its contamination.

### **Precaution**

Antihistamines have a drying effect, which can make airway clearance more difficult. Patients with CF should, in general, avoid the use of these medications.

### **INFLUENZA**

Influenza, or the flu, refers to an acute viral respiratory infection, with type A and B influenza viruses being more common.

Influenza is highly contagious when symptoms are present in patients. The pathogen can be spread by droplets or through contact with contaminated items handled by the patient.



Excellent hand hygiene is an important step to prevent the spread of the virus.

### **Main Symptoms**

The onset is often abrupt. In mild cases, symptoms may resemble those of the common cold:

- Fever, chills, headache, malaise, and myalgia (muscle pain)
- Profuse nasal drainage
- Sore throat and cough

### **Selected Nursing Tips**

1. For uncomplicated influenza, treatment consists of establishing an accurate diagnosis, symptomatic relief, and complication prevention.
2. Thorough hand washing is an essential part of universal precautions.
3. Antibiotics are not effective in treating viral infections, including viral influenza, unless they are complicated by bacterial infection.
4. Advise patients to avoid crowds to protect themselves from bacterial infection as well as to contain the spread of the virus. Increase fluid intake and ensure adequate rest. Watch for signs of secondary pneumonia, such as auscultated crackles or purulent sputum.
5. Educate patients per protocol about vaccination, including its possible adverse effects and its contraindications in certain populations.
6. Aspirin may reduce fever and pain, in addition to having anti-inflammatory and anticoagulant effects. This medication is contraindicated for children due to its possible association with an acute febrile illness (Reye's syndrome).

### **Point to Consider**

Influenza viruses have a remarkable ability to mutate over time, which necessitates the need for annual vaccination against new

strains. Some of the evolving strains may have pandemic potential, as they constantly change. Take preventive measures as required by public health authorities.

### **Precaution**

Patients who are allergic to eggs, feathers, chickens, or who have histories of certain conditions or disorders, such as Guillain-Barré syndrome, should consult the practitioner regarding flu prevention. Alternative approaches may be adopted. However, antiviral agents such as oseltamivir (Tamiflu) or amantadine (Symmetrel) are not the same as vaccinations.

## **LARYNGEAL CANCER**

Laryngeal cancer refers to uncontrollable malignant cell growth involving the vocal cords or some other part of the larynx. Squamous cell carcinoma is a common type. Risk factors for this disease include smoking, excessive alcohol intake, vocal abuse, and chronic laryngitis.

### **Main Symptoms**

Manifestations may vary depending on the location of the tumor, but often include the following symptoms:

- Persistent hoarseness and cough
- Sore throat, or a feeling of a lump with burning sensation in the throat, especially when drinking hot or citrus fluids
- Dysphagia (difficulty swallowing), ulceration, and foul breath
- Dyspnea, enlarged cervical lymph nodes, and weight loss

### **Selected Nursing Tips**

1. Before a laryngectomy, the patient's reading and writing abilities need to be assessed, and a means of communication established (e.g., the call light or a writing pad). Encourage patients to express their feelings related to fears or depression; listening can be therapeutic. Clarify any

misconceptions they may have to allay their anxiety and help them cope with the disease process, as it may pose threats to their body image and self-esteem.

2. In total laryngectomy, the patient's laryngeal structures are removed, and the tracheostomy is permanent. Precautions must be taken to prevent water from entering the stoma (e.g., no participation in water sports after the surgery). Educate the patient or caregivers to cover the stoma when showering or bathing; teach and have them demonstrate competence in performing stoma-related care.
3. Postoperatively, maintain a patent (open) airway, and clear secretions by suctioning as indicated. (The secretions are likely to increase due to the resultant structural and functional changes.) Properly raise the head of the bed to promote lymphatic drainage and decrease pressure on the suture line. Take measures to prevent aspiration pneumonia, because patients who have had laryngectomy may experience a depressed cough reflex.
4. Shortly after a patient undergoes a total laryngectomy, the nurse should closely monitor the patient for signs of dyspnea and bleeding and position the patient properly as recommended.
5. After a total laryngectomy, the patient may use alternative communication methods. For example, the patient may be taught by a speech therapist over time to learn to use "esophageal speech," in which swallowed or compressed air is expelled across constricted tissue in a controlled "belch" to create sounds and form words. Some patients may not be successful in learning this technique.
6. Patient teaching concerning self-care changes (due to the loss of functional abilities, such as sense of smell) is an important part of the nursing role. A humidifier or house plants in the home, if appropriate, may help compensate for the loss of the humidifying mechanism of the nose and pharynx until the body has adjusted to the changes.

**Points to Consider**

1. Prolonged use of tobacco (smoking or smokeless) and alcohol increases the risk for developing laryngeal cancer. Other risk factors include vocal straining and exposure to toxins or radiation.
2. Radiation of the head and neck after laryngectomy frequently causes xerostomia (dry mouth), stomatitis (irritation of the oral mucous membranes), and dysgeusia (reduced sense of taste).

**Precautions**

1. The outer tracheostomy tube should not be removed unnecessarily, because the stoma may close.
2. When moving the patient postoperatively, make sure to support the neck and head.
3. Before the postoperative patient is cleared for oral intake, the speech therapist and the radiologist may conduct a swallow study to evaluate aspiration risks.

**LARYNGITIS**

Laryngitis—an acute or chronic inflammation of the larynx, which contains the vocal cords—can be caused by viral or bacterial pathogens, as in an upper respiratory infection, or induced by other factors, including voice overuse, exposure to chemicals and irritants, or gastroesophageal reflux. It can also be brought on by conditions such as temperature fluctuations, nutritional deficiencies, or an immunosuppressed state.

**Main Symptoms**

- Mild to complete loss of voice, accompanied by red and sore throat
- Flu-like symptoms
- Possible dry cough and fever
- Pain associated with swallowing and speaking

A persistent hoarseness is often the only clinical feature of chronic laryngitis.

### Selected Nursing Tips

1. Encourage patients to rest their voice and avoid smoking and/or alcohol. Anticipate their needs, and use alternative communication methods, such as a writing pad or sign language.
2. Analgesics and throat lozenges are often used to relieve the symptoms of viral infection; antibiotics are commonly prescribed for bacterial infection.
3. Underlying causes should be identified and corrected or removed. Increase fluid intake, if not contraindicated.

### Points to Consider

1. Maintain humidification by taking throat lozenges, using a vaporizer in winter, and minimizing air-conditioning use in summer.
2. Laryngeal edema in severe cases may result in airway obstruction, necessitating tracheotomy preparation.

### Precaution

Advise the patient to report difficulty swallowing, pinkish sputum (possible hemoptysis), or noisy breathing. Prolonged hoarseness needs to be evaluated to rule out malignancy.

### LEGIONNAIRES' DISEASE

Legionnaires' disease is often characterized by multiple-system involvement in addition to respiratory infection (pneumonia). The causative bacterium, *Legionella pneumophila*, is typically transmitted via inhalation of vapors or aerosolized water droplets from a water source, especially contaminated standing warm water. Spread of the pathogen may be linked to plumbing, cooling systems, or respiratory equipment. The bacteria can also be found in soil.

## **Main Symptoms**

- Fever, malaise, and headache
- Dyspnea and cough that eventually becomes productive
- Weakness and myalgia (muscle pains)
- Gastrointestinal problems, including diarrhea

Legionnaires' disease may also result in serious complications, including hypotension or organ failure.

## **Selected Nursing Tips**

1. Provide circulatory and ventilation support; administer prescribed medications, such as antibiotic or antipyretic (temperature-lowering) agents.
2. Monitor the patient's status closely; replace fluids and electrolytes as ordered.
3. Encourage coughing and deep breathing to improve lung function. Watch for signs of hypoxemia, such as confusion or restlessness, which may require repositioning, suctioning, or further oxygenation therapy.
4. Advocate about proper treatment and maintenance of water systems, including any water sources for drinking, bathing, cooling, or decoration. Use prescribed (sterile) water for aerosolizing breathing treatment and clean the equipment as required to prevent contamination

## **Point to Consider**

Smokers and people who are immunocompromised or have chronic debilitating diseases are relatively more susceptible to Legionnaires' disease (which usually is not spread from person to person).

## **Precaution**

Monitor patients for signs of complications, including shock (as evidenced by hypotension, thread pulse, and sweating with clammy skin) and organ failure.

## LUNG CANCER

The prognosis for patients with lung cancer, a malignant tumor within the lung, varies depending on the stage at diagnosis and the growth rate of the specific cell type (e.g., small cell lung cancer versus non-small cell lung cancer and its various subtypes). Risk factors include, but are not limited to, tobacco use, secondhand smoke, exposure to harmful substances, and other predisposing conditions (e.g., lung diseases).

### Main Symptoms

Lung cancer is often asymptomatic in its early stages. Eventually symptoms occur depending on many factors, such as the tumor size and location and its metastatic effects. General warning signs and possible symptoms include the following:

- A persistent cough or a change in the character of cough
- Dyspnea, wheezing, and hoarseness
- Chest pain aggravated by a deep breath
- Recurrent respiratory infections or pleural effusion
- Blood-tinged sputum (hemoptysis)
- Palpable lymph nodes
- Anorexia, weakness, and weight loss

### Selected Nursing Tips

1. Assess patients' risk factors and advise them to seek additional medical attention as appropriate, because early detection and treatment are likely to increase patient survival rates.
2. Presurgery teaching should cover possible postoperative procedures, such as placement of a chest tube, IV catheter insertion, and urinary catheterization.
3. Position the postoperative patient on the recommended side that will promote drainage and lung expansion.
4. Remind the patient with terminal lung cancer experiencing severe pain to ask for analgesic medication before the pain becomes extreme.

5. Provide supportive care and teaching to minimize complications and facilitate recovery from surgery, radiation, chemotherapy, and other treatment therapies.
6. Following a one-sided pneumonectomy (removal of an entire lung), assess the trachea per protocol, as it may deviate from midline. A semi-Fowler's (30 to 45 degrees) position may facilitate the patient's breathing without inducing decompensating fatigue.

### Points to Consider

1. Proper positioning and deep breathing can reduce the patient's risk of developing complications, such as atelectasis. During inspiration, the diaphragm descends, which increases thoracic volume and lowers pressure, allowing air to rush into the alveoli.
2. Radiation may be used preoperatively to reduce tumor size for surgical excision or postoperatively as an additional therapy.

### Precaution

Warn patients receiving radiation therapy against wearing restrictive clothing and being exposed to the sun. Take other protective measures as well to minimize skin breakdown.

### OBSTRUCTIVE SLEEP APNEA

People who suffer from obstructive sleep apnea (OSA) characteristically experience repeated temporary cessations of breathing (apnea) during sleep. In susceptible patients, such as those who are obese or who have a large neck size, a partial or complete upper airway obstruction may occur when pharyngeal muscle tone is reduced during sleep, impeding airflow; in such individuals, the pharynx can be compressed during inspiration by surrounding soft tissues. Recurrent apneic episodes may decrease blood O<sub>2</sub> saturation and increase carbon dioxide concentration.



**Main Symptoms**

- Loud snoring and frequent awakening at night to make breathing possible
- Insomnia
- Daytime sleepiness at inappropriate times
- Morning headaches due to hypercapnia, which may cause cerebral vasodilation (and headache)
- Inability to concentrate and impaired memory
- Personality changes, irritability, and typically lack of awareness of the sleep apnea problem

**Selected Nursing Tips**

1. Make appropriate referrals, as many individuals may not realize the seriousness of this condition and go undiagnosed. Assist patients to further identify the causes and related problems.
2. Instruct patients to minimize their use of alcohol or sedatives. Explain to the susceptible individuals the risk factors associated with OSA, such as obesity and altered upper airway structures; encourage weight reduction when indicated.
3. Anticipate patients' knowledge deficits regarding treatment options or possible complications, and provide education to enhance their understanding to facilitate their compliance with the mask use for continuous positive airway pressure (CPAP) or bilevel positive airway pressure (BiPAP) while sleeping.

**Points to Consider**

1. Continuous positive airway pressure is primarily used by patients with OSA who can breathe independently; it is intended to prevent the hypoxemia that may occur during sleep. The machine blows enough air into the patient's nose (and/or mouth) to maintain a level of positive airway pressure that keeps the alveoli open for the entire breathing cycle. Some patients cannot adapt to exhaling against the

high pressure delivered by CPAP; in such cases, bilevel positive airway pressure therapy may be a better choice.

2. The use of BiPAP can provide cooperative patients who can breathe spontaneously with needed support of both higher inspiratory and lower expiratory positive airway pressure in conjunction with oxygen.
3. Assessing the patient's oxygen saturation at night with pulse oximetry may provide useful information for evaluating the patient's oxygenation and the need for further treatment.
4. A variety of treatment approaches are possible. Surgical management of OSA is reserved for patients whose symptoms cannot be relieved with other measures. Benefits need to be weighed against the adverse effects of the treatments, including medications.

### **Precaution**

Obstructive sleep apnea may induce hypertension and other abnormalities. When recurrent apneic episodes result in hypercapnia and hypoxia, the subsequent sympathetic response poses an increased risk for developing serious cardiovascular problems, including pulmonary hypertension.

### **PNEUMONIA**

In pneumonia, there is inflammation of the lungs due to infectious organisms or other conditions and offending agents (as in pneumonitis, which predisposes the patient to infection), consequently diminishing the optimal gas exchange. Numerous factors may increase a patient's risk of developing pneumonia, including aspirated food, inhaled gases, contaminated breathing treatment equipment, prolonged immobility, smoking, alcohol intoxication, and impaired breathing or airway clearance. Various terms may be used to describe pneumonia based on different criteria or etiologies, such as "hospital-acquired pneumonia" and "aspiration pneumonia," among others.

## Main Symptoms

Manifestations depend on the type of pneumonia, the etiologic agents, and coexisting underlying conditions. Presentations of bacterial pneumonia are possibly associated with the following symptoms:

- Diminished breath sounds upon auscultation over a consolidated, fluid-filled area, and crackles
- Productive coughing with greenish sputum and positive sputum culture
- Pleuritic chest pain worsened by deep breathing or cough
- Fever, chills, tachypnea, tachycardia, and malaise
- Chest X-ray showing areas of consolidation (solidification) or patchy infiltrates

Older patients with COPD who also develop pneumonia may not exhibit the typical signs. Instead, they may simply appear lethargic, confused, or dehydrated, with changes in respiratory status.

## Selected Nursing Tips

1. Obtain a sputum sample for a culture and sensitivity test before antibiotic therapy is initiated. The sputum specimen is optimally collected in the early morning from a deep cough after brushing the teeth.
2. During the acute phase of pneumonia, maintaining bed rest may minimize the body's metabolic demand for oxygen.
3. Monitor lab results and maintain fluid and electrolyte balance; provide adequate nutrition. During and after eating, the patient's head and chest should be properly elevated to reduce the risk of aspiration pneumonia.
4. Patients of advanced age and those with long-term illness or in group-living settings are more susceptible to pneumonia. Annual influenza vaccination is usually encouraged and vaccination against pneumococcal and influenza

infections is recommended, per protocol, for high-risk patients, such as those with chronic heart or lung disease.

5. Encourage immobile or postoperative patients to cough, turn, and deep breathe. To reduce pain while coughing, the patient may splint his or her chest with a pillow.

### **Point to Consider**

Severe acute respiratory syndrome (SARS) refers to a viral respiratory infection, which is highly contagious. It is mainly transmitted via respiratory tract by means of airborne droplets or contact with droplet-contaminated objects. Patients with SARS initially may experience fever, headache, and general discomfort. Cough and difficulty breathing may develop later. Currently, management of patients with SARS is primarily supportive; the efficacy of antiviral therapy is unclear so far.

### **Precaution**

To prevent tube-feeding-related aspiration pneumonia, check the placement of the feeding tube and the residual per protocol before administering enteral feeding to patients. Keep the patient's chest and head properly elevated during and after the feeding.

### **PNEUMOTHORAX**

To maintain lung inflation, the pressure inside the double-layered pleurae normally is lower than the atmospheric pressure (negative pressure). In pneumothorax, the negative pressure in the pleurae is disrupted due to the presence of air, which causes the affected lung or portion of lung to collapse.

Causative factors may range from chest injury to spontaneous air bleb rupture, causing air to enter the pleural space. When a partial or complete lung collapse occurs, gaseous exchange and cardiac output will be impaired. Pneumothorax is considered an emergency and requires immediate medical intervention.

## Main Symptoms

The manifestations of pneumothorax are related to the size of the affected area and the underlying conditions or causes, with specific terms being used to describe the variants.

In a *spontaneous* (or simple) pneumothorax, the patient may not have sustained trauma. This type of pneumothorax can occur in a healthy person through an air bleb rupture, producing no obvious symptoms. It may also be associated with certain lung diseases, such as severe emphysema.

In a *traumatic* pneumothorax (after having sustained major injury to the chest), circulatory function may be seriously affected. When both air and blood are found in the chest cavity, the condition may be termed a *hemopneumothorax*.

In *tension* pneumothorax, the air taken in with each breath increases pressure (tension) in the pleural space, but it cannot escape or be expelled. This condition may potentially cause the lung to collapse and lead to mediastinal shift, in which the heart, great vessels, and trachea shift to the unaffected side.

In general, patients with pneumothorax may display the following respiratory symptoms:

- Sudden, sharp pleural chest pain worsened by breathing, along with shortness of breath
- Decreased breath sounds on the affected side
- Asymmetrical chest movement with signs of shortness of breath
- Cyanosis, diaphoresis, and tachycardia
- Anxiety and air hunger

## Selected Nursing Tips

1. Emergency care and interventions are required to treat pneumothorax that affects circulatory function, including tension pneumothorax and traumatic pneumothorax. Conservative treatment may include monitoring of vital signs, bed rest, and oxygen therapy.

2. Negative pressure in the pleural space may need to be re-established with medical interventions by or under the guidance of medical experts. Monitor the patient's oxygen saturation rate and vital signs; ensure adequate oxygenation. Observe the patient closely and report promptly any signs of complications, such as pressure in the chest, significant changes in vital signs, difficulty breathing, hemorrhage, or cyanosis.
3. In a trauma patient, diminished or absent breath sounds over the affected areas with sudden sharp chest pain related to breathing and dyspnea should arouse suspicion for pneumothorax with impaired lung function. Immediate proper actions and interventions are indicated.
4. In hemothorax, blood is present in the pleural space, often resulting from chest injury. When the excessive blood is removed with a chest tube, it may be reinfused within hours as per protocol. The blood for autotransfusion must be collected and filtered to eliminate air and other substances; a special autotransfusion machine may be used for that purpose.
5. Oxygen saturation can be monitored continuously using pulse oximetry; providing optimal oxygenation is essential in case of pneumothorax.

### Points to Consider

1. Managing chest tube drainage per guidelines and orders is an important aspect of nursing care. The chest tube is used to remove air and excess fluid from the pleurae, thereby allowing the affected lung to re-expand. As with any invasive procedure, before a chest tube is inserted in an alert and oriented patient, the patient or his or her guardian must sign an informed consent form.
2. The traditional water seal chest drainage system has been largely replaced with newer technology (e.g., dry-suction water-seal drainage or dry-suction one-way valve system). The nurse should be familiar with the safety mechanisms of the system being used.

3. Make sure that the drainage tubing does not kink, loop, or interfere with drainage function or the patient's movement. Secure all the connections; air leaking or trapping in the pleural space can lead to tension pneumothorax. Correct the causes of leakage, as evidenced by constant bubbling in the water-seal chamber in a wet system (or as detected by the air-leak indicator in a dry system with a one-way valve), and report a not-correctable leakage, obstruction, or other problems to the physician. Normally, the water in the water-seal chamber (in wet systems) fluctuates with the patient's breathing, reflecting the pressure in the pleurae, with intermittent gentle bubbles being noted (before the lung is fully re-expanded).
4. The drainage system must be kept below the level of the patient's chest. The tubing should not be clamped to prevent tension pneumothorax, except momentarily when absolutely necessary or specifically ordered.
5. Position patients in good body alignment, and reposition them at proper intervals. Deep breathing or coughing promotes drainage and removal of secretions and helps prevent atelectasis.
6. To prevent atelectasis, analgesics may be needed if a patient with a chest tube experiences severe pain when taking deep breaths.

### **Precaution**

Pneumothorax is a life-threatening disorder, which may produce signs of severe respiratory distress, especially in case of tension pneumothorax, and which requires immediate medical intervention.

### **PULMONARY EDEMA**

In pulmonary edema, abnormal fluid buildup occurs in the alveoli and interstitial spaces of the lungs, often secondary to a cardiac disorder (e.g., myocardial infarction or an exacerbation of chronic heart failure) or a non-cardiac disorder that causes

fluid retention (e.g., renal failure). This fluid buildup results in decreased lung compliance and gas exchange.

A wide range of conditions can predispose the patients to pulmonary edema, including excessive volume of intravenous (IV) fluid, hypervolemia, acute respiratory distress syndrome, trauma, severe burns, shock, and severe nutritional deficiency (hypoalbuminemia with decreased colloid osmotic pressure). Pulmonary edema, a life-threatening medical emergency, can develop either gradually or rapidly (in a few minutes).

### **Main Symptoms**

- Restlessness (resulting from inadequate blood flow to the brain), anxiety, and confusion
- Difficulty breathing and air hunger, especially upon exertion or while lying down
- Blood-tinged, pink, frothy sputum
- Signs of hypoxia (e.g., cool, cyanotic, clammy skin)
- Signs of pulmonary congestion, such as a sense of “drowning” or “suffocating” in one’s own secretions
- Arterial blood gas analysis and pulse oximetry indicating worsening hypoxemia (or other abnormalities)

### **Selected Nursing Tips**

1. Monitor susceptible patients for early signs of pulmonary edema, especially breathing problems, abnormal breath sounds, tachycardia, and signs of pulmonary congestion, such as auscultated crackles or peripheral edema, which may possibly indicate pulmonary fluid accumulation.
2. Pulmonary edema is a life-threatening emergency. When signs of acute pulmonary edema are noted, immediate nursing actions are required. Stay with the patient and call for help. Notify the practitioner promptly. Initiate other interventions per protocol and as appropriate, such as oxygen supplementation, cardiac monitoring, starting an IV line, and suctioning the patient as indicated, in collaboration with the healthcare team to correct fluid overload, improve



cardiac functioning, and promote pulmonary gas exchange. (In severe cases, endotracheal intubation and mechanical ventilation may be required for some patients.)

3. To reduce the heart's workload, the patient needs to use stress- and activity-reducing techniques, such as using a bedside commode. Raise the head of the bed, as appropriate. Placing the patient's legs in a dependent position at times may decrease venous return and pulmonary congestion.
4. Monitor lab values, fluid intake, and urine output. Instruct the patient to keep a daily weight record at home to assess fluid status. Identify and avoid precipitating factors; control fluid and salt intake to prevent fluid retention and the recurrence of pulmonary edema.

### **Point to Consider**

A potassium supplement may be ordered for patients who take potassium-depleting diuretics, such as furosemide (Lasix); monitor their serum potassium level. When patients are on potassium-sparing diuretics, such as spironolactone (Aldactone), they should avoid consumption of potassium-containing salt substitutes.

### **Precaution**

Narcotics are not commonly used in patients with respiratory distress. However, morphine may be prescribed for dyspnea from pulmonary edema that is unrelated to chemical respiratory irritants. Monitor for its side effects, especially respiratory depression. Ventilation support should be readily available.

### **PULMONARY EMBOLISM**

In pulmonary embolism (PE), there is a blockage in the pulmonary arterial bed, which impedes pulmonary blood flow. It may be caused by a dislodged thrombus (blood clot) or another type of embolus (of a solid, liquid, or gaseous mass), such as tumor cells, bone marrow, amniotic fluid, or air. PE frequently results from thrombi that originate in the deep veins, commonly in the calf or thigh.

As a result of PE, pulmonary vascular resistance may increase. Gas exchange will be severely impaired with potentially fatal consequences, if this acute condition is not recognized and treated promptly.

### **Main Symptoms**

The manifestations of PE can be nonspecific. The clinical picture may vary with the location and the severity of the occlusion, or may mimic that of other cardiopulmonary disorders. Patients may develop the following symptoms:

- Shortness of breath and rapid, weak pulse
- Sudden chest pain that is associated with breathing
- Cough with blood-tinged sputum from alveolar damage
- Apprehension due to sudden reduction in oxygenation
- Fever
- Diaphoresis, syncope (fainting)

These symptoms can develop rapidly. Early detection is essential: Failure to recognize this condition early and delay in treatment are often the cause of PE-related death.

### **Selected Nursing Tips**

1. Pulmonary embolism is a life-threatening emergency requiring immediate medical intervention to stabilize the patient's cardiac and pulmonary systems as per protocol.
2. Identifying vulnerable patients and taking measures to prevent clot formation are important roles for nurses. Advise patients on ways to prevent thrombosis, such as engaging in safe, moderate exercise and avoiding prolonged immobility or restrictive clothing.
3. Patients on bed rest who are at risk for thrombosis should avoid pressure on the popliteal area. For example, they should not place a pillow under their knees, as it may impede the circulation and promote clot formation.

4. To prevent venous stasis and reduce the risks for PE, encourage patients to walk as soon as appropriate after surgery or when the condition is stabilized.
5. Administer medication and oxygen as prescribed; maintain cardiopulmonary function during the treatment of emboli. Carefully monitor patients' thrombolytic or anticoagulant therapy and lab test results.
6. Emphasize the importance of compliance with possibly long-term therapy to prevent the recurrence of PE. Check patients' medication lists to report concurrent use of aspirin or other nonsteroidal anti-inflammatory drugs while they are on anticoagulants to prevent bleeding.
7. When patients with PE are discharged from the hospital, provide education on preventing dehydration by taking extra fluids to thin the blood when necessary (e.g., on a long trip).

### Points to Consider

1. Heparin and warfarin (Coumadin) may inhibit the growth of existing clots and reduce the likelihood that new clots will form. Their dosage is usually adjusted frequently based on the results of blood coagulation studies, such as the international normalized ratio (INR), per protocol. It is necessary to cross-check the dosage with a coworker to ensure dosage accuracy. Patients should also be closely monitored for signs of bleeding. Advise patients to take measures to prevent tissue injuries (e.g., using a safety shaving razor or soft toothbrush). There are a number of anticoagulant agents, including enoxaparin (Lovenox); when an anticoagulant is used, monitor the patient for signs of bleeding (or anemia), among other side effects.
2. Patients with acute massive pulmonary embolism may need thrombolytic therapy, using agents such as alteplase (Activase), a tissue plasminogen activator. These agents should be given within the first 3 hours of the onset of the

symptoms or within the time frame directed per protocol. Closely observe the medication's administration guidelines. Maintain continuous cardiac monitoring on patients receiving thrombolytic therapy for signs of arrhythmia; assess for signs of overt bleeding or having occult blood in any body substance.

3. Leaving an IV catheter in place for a prolonged time may increase the risk for clot formation, as can long-term use of peripherally inserted central catheters.
4. Crossing the legs may affect circulation and promote clot formation.

### **Precaution**

A clot can originate in a deep vein in an immobilized patient, especially in the calf or thigh. Avoid massaging patients' legs in a vigorous manner because it can cause blood clots to become dislodged and result in embolization.

### **PULMONARY HYPERTENSION, SECONDARY**

In pulmonary hypertension, the pressure in the pulmonary arteries is higher than normal, but not related to aging or altitude. Primary pulmonary hypertension (with no known etiologic conditions) is rare, but potentially fatal. Many cases of secondary pulmonary hypertension are linked to other conditions or disorders that cause hypoxemia potentially leading to anatomic vascular changes and increased pulmonary resistance in predisposed patients. These include obstructive sleep apnea, obesity, and altered immunologic disorders, as well as chronic pulmonary diseases, such as chronic obstructive pulmonary disease.

### **Main Symptoms**

The presentation of secondary pulmonary hypertension may be obscured by, and similar to, the presentation of the underlying

disorders. Potential manifestations include the following symptoms:

- Dyspnea on exertion
- Fatigue and weakness
- Chest pain and signs of hypoxemia, such as altered mental status
- Exertional syncope (fainting)

Many patients may eventually show signs of right-sided heart failure, such as peripheral edema, jugular vein distension (JVD), or ascites.

### **Selected Nursing Tips**

1. Identify patients at high risk for developing pulmonary hypertension; administer appropriate oxygen therapy. Skilled supportive care entails careful observation while carrying out treatment orders to slow the progress of the disease.
2. Monitor the patient's vital signs and ABG analysis for hypoxemia or respiratory acidosis (e.g., hypercapnia); watch for changes in level of consciousness or restlessness and impaired tissue perfusion.
3. Observe the patient's response to oxygen therapy for hypoxemia; report undesirable outcome and adjust the patient care plan accordingly. Correct the underlying causes in collaboration with the healthcare team, such as obstructive sleep apnea.
4. Take measures to maintain optimal fluid status for the patient; check for signs of fluid overload, such as jugular vein distension.
5. Provide patient education regarding prescribed medications and diet. Remind the patient to refrain from overexertion and to obtain adequate rest as needed.

### **Points to Consider**

1. Unlike systemic blood pressure, pulmonary arterial pressure cannot be measured indirectly. Thus, secondary

pulmonary hypertension is not clinically recognizable until the disease progresses to a late stage.

2. Primary pulmonary hypertension is uncommon. For patients with secondary pulmonary hypertension, their prognosis may depend on the severity of the underlying diseases and the alteration of the pulmonary vascular bed.

### Precaution

Prevent or treat conditions that can induce hypoxemia, which may initiate the disease process of pulmonary hypertension.

### TUBERCULOSIS

Tuberculosis (TB), an infectious disease, is primarily caused by *Mycobacterium tuberculosis*, a bacterium that frequently affects the lungs and is commonly transmitted by the airborne route. This pathogen can be transmitted via sputum or droplets from a patient with active TB as a result of coughing, sneezing, laughing, or talking—that is, the bacteria pass through the respiratory tract of the patient. Transmission may occur after close, frequent, and prolonged contact.

### Main Symptoms

Symptoms of TB may be nonspecific, including unexplained weight loss, weakness, night sweats, or low-grade afternoon fever. Hemoptysis (bloody sputum) is largely associated with more advanced TB cases.

Elderly patients may have atypical presentations, such as anorexia, weight loss, or a change in mentality and behavior. Some may have a delayed (or no) reaction to the tuberculin skin test, possibly due to age-related dysfunction of immunologic memory.

### Selected Nursing Tips

1. Patients with active TB should be placed in respiratory isolation, staying in a private (possibly negative-pressure) room in which the air is vented to open air outside, as per protocol or requirement.

2. An important nursing role in caring for patients with TB is to educate patients about the medications, including the dosage schedule and side effects. Emphasize the importance of strict adherence to the regimen, preferably watching patients swallow the medications.
3. Ensure adequate nutrition by providing frequent, small, high-carbohydrate and high-protein meals with essential nutrients and vitamins. Supplemental vitamin B<sub>6</sub> is often prescribed if the patient receives isoniazid (INH) to prevent drug-induced neuritis.
4. Stress the importance of getting plenty of fresh air and reporting signs of persistent cough, fever, or hemoptysis, which may indicate recurrence.
5. The proper way to administer an intradermal Mantoux PPD (purified protein derivative) TB test is to hold the syringe with the needle almost parallel to the skin of the person's forearm while inserting the needle. The result is read within 48-72 hours (or as recommended) and recorded as the diameter of the induration (hardened area).

### Points to Consider

1. Tuberculosis is often treated with multidrug therapy, such as isoniazid (INH), rifampin (Rifadin), and pyrazinamide (Tebrazid), or a fixed combination of the drugs for many (possibly 6-24) months.
2. A positive Mantoux test may indicate the patient has been exposed to TB or bacilli Calmette-Guérin (BCG) vaccine. In an immunosuppressed patient, however, a negative Mantoux test does not necessarily exclude TB infection, because the patient may not be able to develop an immune response adequate to produce a positive skin test result. The X-ray will show the lesion if it is large enough. A sputum acid-fast bacilli (AFB) smear together with TB cultures can be used to support the diagnosis of tuberculosis. (The lab technique is called "acid-fast bacilli smear" due to the fact that bacilli are not easily stained; once the test is done with a dye, it is

difficult to remove the stain, even with acid alcohol.)

*M. tuberculosis* is susceptible to heat and ultraviolet light.

3. Before airborne precautions are discontinued, make sure the required number of consecutive sputum cultures are negative, free of acid-fast bacteria. The patient may still be infected, but the disease is no longer contagious at this point. For TB screening purposes, once an individual has had a positive TB skin test, an X-ray should be used instead of the Mantoux test in later years.
4. Unlike *Staphylococcus aureus*, the TB bacillus is carried in exhaled droplets of patients with an active TB infection, usually not on their personal items. Adhere to respiratory precautions; label all sputum specimens with AFB precautions.

### Precautions

1. In addition to being toxic to some organs such as the liver, rifampin may cause reddish-orange discoloration of secretions such as urine, sweat, saliva, or tears, which may stain contact lens. Warn the patient to limit intake of alcohol while on rifampin or INH as instructed by the physician.
2. Long-term isoniazid therapy may cause drug-induced peripheral neuropathy (e.g., a sensation of tingling or numbness), due to vitamin B<sub>6</sub> deficiency. Supplemental pyridoxine (vitamin B<sub>6</sub>) is often prescribed to mitigate this effect.
3. Monitor for the signs of adverse effects of antitubercular antibiotics. Streptomycin, an aminoglycoside, may cause nephrotoxicity, ototoxicity, and neurotoxicity, among other side effects. Monitor the patient's serum creatinine and blood urea nitrogen (BUN) level; instruct the patient to report hearing loss and ringing in the ears.

### OTHER POINTERS AND CONCERNS

#### PERTAINING TO ALLERGY

The patient with allergic rhinitis needs to be taught how to use a nasal inhaler to ensure better inhalation. Specifically, the



patient should hold one nostril closed while using a nasal inhaler to spray the medication into the other nostril.

Allergic reaction to a contrast medium used for medical tests or procedures may have systemic or local manifestations, including respiratory distress, hypotension, stridor, localized itching, or edema.

Life-threatening anaphylactic reactions and respiratory distress can be caused by latex allergy in susceptible individuals. Before touching patients with hands wearing latex gloves or anything made of latex such as a urinary catheter, make sure the patient is not allergic to latex.

### **PERTAINING TO BREATHING**

Hearing and feeling the air movement from a patient's mouth and nose are more effective ways to determine the patency of an airway than observing the chest rising and falling.

A sitting position, if not contraindicated, may facilitate lung expansion and exhalation in a patient who is experiencing difficulty breathing. This position decreases the abdominal pressure on the diaphragm (the dome-shaped muscle that separates the abdomen from the thoracic cavity).

Upon auscultating rales (crackling) in the base of the lungs, the nurse may ask the patient to take a deep breath or cough. Hypoventilation (reduced rate and depth of breathing) may also be the cause of rales.

Pursed-lip breathing (exhaling through pursed lips for two or three times as long as inhaling) facilitates maximum elimination of CO<sub>2</sub> in patients with COPD. This kind of breathing works by forcing the patient to use the abdominal muscles to keep the air passages open for more complete exhalation.

Cheyne-Stokes respirations are characterized by a period of apnea followed by deep, frequent breathing. These respirations are a serious sign indicating a grave prognosis in adult patients.

Kussmaul's breathing is a deep, rapid, gasping respiration often associated with diabetic ketoacidosis or coma.

**PERTAINING TO CARBON MONOXIDE POISONING**

Toxicity caused by carbon monoxide can be lethal and requires immediate treatment. Hemoglobin absorbs carbon monoxide much more readily than it absorbs oxygen. In red blood cells, hemoglobin is the iron-containing pigment that carries oxygen from the lungs to the tissue cells. When hemoglobin is bound with carbon monoxide, it loses its oxygen-carrying capability. (Pulse oximetry does not provide valid information in patients with carbon monoxide poisoning, because hemoglobin will be saturated with carbon monoxide in this condition.)

Individuals with carbon monoxide poisoning may have altered mental status, as the central nervous system needs a constant and sufficient supply of oxygen to function properly. They may experience headache, weakness, dizziness, and slight confusion. They may also display changes in skin color, ranging from pale and cyanotic to “cherry red.”

In addition to carrying out treatment orders, nurses should institute safety precautions to minimize the risks of falls and injuries in patients with carbon monoxide poisoning. Provide fresh air or oxygenation to reverse hypoxia. Loosen constrictive clothing, keep the patient warm, and reduce stimuli to decrease oxygen consumption.

**PERTAINING TO POSTOPERATIVE CARE FOR NASAL SURGERY**

After a patient has undergone nasal surgery, signs of frequent swallowing should prompt the nurse to conduct further examination to rule out the possibility of blood trickling down the throat.

Monitor the patient for signs of ineffective breathing due to possible airway obstruction, resulting from nasal edema or dislodgement of nasal packing. Instruct the patient to avoid activities requiring exertion, such as exercise, vigorous coughing, or straining on defecation, which increase stress on the sutures and the risk of bleeding—the nasal cavity is extremely vascular. The patient may need stool softeners to avoid constipation.

The first step in managing nosebleed (epistaxis) is to have the patient lean forward while sitting to prevent aspiration of blood. Apply pressure by pinching the soft portion of the nose against midline septum to stop bleeding.

After surgery, intermittent cold compresses may be applied to the nose, as appropriate, for its vasoconstriction effect to reduce swelling, bleeding, and pain. Warm, moist compresses may be used later for comfort in the tender area.

### **PERTAINING TO SIDE EFFECTS OF NARCOTICS**

One of the many serious side effects of narcotic analgesics (pain pills) is respiratory depression. Assess the patient's level of consciousness as well as the respiration rate as indicated. Patients with a very low respiration rate may need to be roused to enhance their breathing, and to check their oxygen saturation rate and breathing sounds. The practitioner may need to be notified for possible lab or treatment orders.

### **PERTAINING TO OXYGENATION**

Arterial blood gas (ABG) analysis provides measurements of pH and the partial pressures of oxygen and carbon dioxide in arterial blood. These values can be used to assess the blood's acid-base balance and the status of pulmonary gas exchange. ABG analysis is often used with other tests to help assess patients' oxygenation as well as help manage their respiratory and metabolic (renal) acid-base balance and their electrolyte status. (The patient's clinical condition has to be taken into consideration concurrently.)

The pH (power of hydrogen) scale is designed to reflect changes in the hydrogen ion ( $H^+$ ) concentration in a simplified way. (An acid is a substance that releases hydrogen ion when dissolved in solution, while a base accepts it.) When the  $H^+$  concentration increases, the pH value decreases. Comparatively speaking, a blood pH value of 7.2 is more acidic than a pH value of 7.3. The pH of human blood must be maintained within a narrow range, 7.35 to 7.45. When blood pH is below

the normal range ( $\text{pH} < 7.35$ ), a problem of acidemia (abnormal acidity of the blood) is present. When blood pH value exceeds 7.45, there is a problem of alkalemia (abnormal alkalinity of the blood).

Partial pressure describes the pressure of a specific gas as part of the total gas mixture.  $\text{PaO}_2$  is a measure of the partial pressure exerted by oxygen when dissolved in the arterial blood.  $\text{PaCO}_2$  is the arterial (partial) pressure of carbon dioxide.  $\text{CO}_2$  is produced by cell metabolism when  $\text{O}_2$  is consumed for energy; it is excreted by the lungs. (Other acids are excreted in the urine by the kidneys.)

Hypoxemia refers to a state in which the arterial blood oxygen is reduced. Hypoxia refers to a state in which tissues receive an oxygen supply inadequate to maintain normal aerobic metabolism. An increased pulse can indicate the heart's attempt to compensate for such a reduced oxygen supply to the body tissues.

The oxygen saturation level indicates the percentage of hemoglobin saturated with  $\text{O}_2$ . In most cases, it can be assessed adequately with a pulse oximeter, by applying the probe over a pulsating vascular bed, such as the fingertips or earlobes. A decrease in the oxygen saturation level may be an early indication of respiratory compromise. Unlike ABG analysis, however, pulse oximetry does not provide information on the partial pressure of carbon dioxide.

The lungs are responsible for  $\text{CO}_2$  removal, with the effectiveness of this process being determined by alveolar ventilation. Increased  $\text{PaCO}_2$  (hypercapnia) and respiratory acidosis usually result from ineffective breathing (hypoventilation). The initial assessment findings in such a case may include a compensatory increase in the rate and depth of respiration, as well as altered mental status.

Hyperventilation due to anxiety (or resulting from the body's compensatory mechanism when the sympathetic nervous system is activated) may cause excessive loss of  $\text{CO}_2$ , leading to respiratory alkalosis. This condition manifests with

symptoms such as tingling around the mouth and dizziness. Having the patient breathe into a paper bag to rebreathe the expired carbon dioxide may offset respiratory alkalosis to some degree.

Remind the patient who is receiving oxygen to be aware of the risks of fire associated with oxygen use: Oxygen supports the combustion process. If the patient is receiving low-dose oxygen and an item nearby catches on fire, first make sure the patient is not in immediate danger, and then turn off the oxygen.

### **PERTAINING TO SUCTIONING**

Suctioning removes oxygen as well as secretions, and it may also cause trauma to the mucosa. Suctioning should be performed on an as-needed basis. It is important not to apply suction while a catheter is being inserted. Intermittent suction should be applied only when a catheter is being withdrawn in a swirling motion.

Properly hyperoxygenate the patient before and after a suctioning procedure, as the depletion of oxygen from the suction may trigger dysrhythmias. Stop suctioning and re-oxygenate the patient as indicated.

After suctioning, auscultate the patient's breath sounds to evaluate the effectiveness of the efforts to clear the airway.

An unconscious patient is unable to maintain a clear airway independently. In caring for a comatose patient, suction as indicated to promote airway clearance.

