

Respiratory Disorders

2

Case Study 18 Tuberculosis

Difficulty: Beginning

Setting: Public health clinic

Index Words: tuberculosis (TB), Centers for Disease Control and Prevention (CDC) guidelines, diagnostic test, risk factors, public health, assessment

► Scenario

You are a public health nurse working at a county immunization and tuberculosis (TB) clinic. B.A. is a 61-year-old woman who wishes to obtain a food handler's license and is required to show proof of a negative Mantoux (purified protein derivative [PPD]) test before being hired. She came to your clinic 2 days ago to obtain a PPD test for TB. She has returned to have you evaluate her reaction.

1. What is TB, and what microorganism causes it?
 - *TB is the common term for tuberculosis. Years ago, it was known as consumption (some older adults still use that term). TB is a communicable disease; it is a requirement that cases be reported to the CDC.*
 - *Tubercle bacilli are called *Mycobacterium tuberculosis*, or *M. tuberculosis* for short.*
2. What is the route of transmission for TB?
 - *TB is an airborne bacterium.*
3. The Centers for Disease Control and Prevention (CDC) recommends screening people at high risk for TB. List five populations at high risk for developing active disease.
 - *Medically underserved populations.*
 - *Recent immigrants from countries with high prevalence of TB.*
 - *Persons who have had domestic or occupational contact with infectious TB cases.*
 - *Alcoholics and IV drug abusers.*
 - *Residents and staff of acute and long-term care facilities, prisons, detention facilities, homeless shelters, and residential facilities for AIDS patients. Some employers may require proof that a person does not have TB before he or she is hired.*
 - *Individuals with chronic disease who are immunosuppressed or have multiple comorbidities.*
 - *Medical personnel who work in the microbiology lab.*
4. Describe the two methods for TB screening.
 - *The preferred method is a TB skin test (Mantoux Two-Step) performed by injecting 0.1 mL of PPD (5 tuberculin units) intradermally in the midvolar region of the left arm using a 27-gauge needle on a tuberculin syringe. A discrete pale elevation of the skin (wheal) should be produced. The person then returns within 48-72 hours to be assessed for a reaction on the arm. This method is required for screening employees and volunteers who are working in or are applying for work at clinics, and for persons born in TB-endemic countries.*

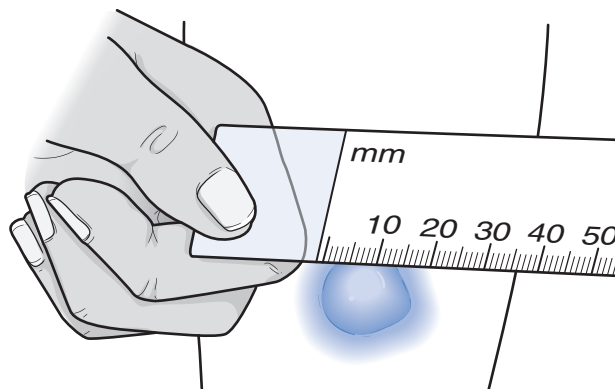
PART 1 MEDICAL-SURGICAL CASES

- TB blood tests (also called *interferon-gamma release assays* or *IGRAs*) measure how the immune system reacts to the bacteria that cause TB. A TB blood test requires only one visit to draw blood for the test. The QuantiFERON-TB Gold test (QFT-G), QuantiFERON-TB Gold In-Tube test (GFT-GIT), and T-SPOT.TB test are three Food and Drug Administration–approved TB blood tests. Test results are generally available in 24 to 48 hours.
5. How do you determine whether a Mantoux test is positive or negative?
 - You measure the area of induration (not erythema), which is defined as a hardened area under the skin. The area is measured transverse to the long axis of the forearm.
 - The CDC has the following guidelines for positive Mantoux reaction:
 - A PPD induration greater than 5 mm is considered positive for persons with, or at risk for, HIV infection; those who have had close, recent contact with someone who has infectious TB; or persons who have a CXR that shows old, healed TB, patients with organ transplants, and people who are immunosuppressed for other reasons.
 - A PPD induration greater than 10 mm is considered positive for foreign-born persons from high-prevalence countries; IV drug users; medically underserved, low-income populations; residents of long-term care facilities; people with chronic illnesses; mycobacteriology lab personnel; and all children and adolescents.
 - A PPD induration greater than 15 mm is considered positive for all other persons.

CASE STUDY PROGRESS

B.A. consumes 3 to 4 ounces of alcohol (ETOH) per day and has smoked 1.5 packs of cigarettes per day for 40 years. She is a natural-born American, has no risk factors according to the CDC guidelines, lives with her daughter, and becomes angry at the suggestion that she might have TB. She admits that her mother had TB when she was a child but says she herself has never tested positive. She says, "I feel just fine and I don't think all this is necessary."

6. What additional information would you want to obtain from B.A. before interpreting her skin test result as positive or negative?
 - Obtain a social history: ETOH ingestion, prescription or illegal drug use, smoking history; note domestic and occupational conditions.
 - Take a medical history: Exposure to TB, S/S of active TB infection, medications, PMH. Find out whether she has had regular access to health care.
 - Ask about current symptoms.
7. Determine whether B.A.'s skin test is positive or negative.



B.A.'s test is positive because the area of induration is greater than 15 mm.

8. B.A. asks you what a positive PPD result means. How will you respond?
 B.A. has been exposed to infectious TB. Because previous testing has been negative and this test was positive, B.A. may have been exposed to active TB since her last negative Mantoux test.
9. What steps will need to be done to determine whether B.A. has an active TB infection?
 First, B.A. will need a CXR. For persons with reactions greater than or equal to 10 mm and persons with symptoms suggesting TB (e.g., cough, anorexia, weight loss, fever)—regardless of the size of the skin-test reaction—this should be done within 72 hours. If the CXR is abnormal, and/or symptoms compatible with TB are present, the patient should also have sputum smear and culture examinations. At least three sputum specimens should be submitted. In the absence of spontaneous production of sputum, suction of laryngeal or pharyngeal mucus is satisfactory if sterile water is used in clearing the catheter.

CASE STUDY PROGRESS

The physician orders a chest x-ray (CXR) and informs B.A. that her CXR is clear (shows no signs of TB). He tells her that she has a latent TB infection and that he will report her condition to the local public health department. The health department will monitor her over time and initiate treatment if she gets TB.

10. What is a latent TB infection (LTBI)?
 Persons with LTBI are infected with *M. tuberculosis* but do not have active TB disease; they do not feel sick or have any symptoms. The only sign of a TB infection is a positive reaction to the tuberculin skin test or to the TB blood tests. Persons with LTBI are not infectious and cannot spread TB infection to others. Overall, about 5% to 10% of patients with latent disease will develop active TB disease at some time in their lives. About half of those people who develop active TB will do so within the first 2 years of infection. For persons whose immune systems are weak, especially those with HIV infection, the risk of developing active TB disease is considerably higher than for persons with normal immune systems.
11. What parameters are used to determine whether treatment should be initiated for LTBI?
 Persons in the following high-risk groups should be given treatment for LTBI if their reaction to the Mantoux tuberculin skin test is greater than or equal to 5 mm:
- HIV-infected persons
 - Recent contacts of a TB case
 - Persons with fibrotic changes on chest radiograph consistent with old TB
 - Patients with organ transplants
 - Persons who are immunosuppressed for other reasons (e.g., taking the equivalent of greater than 15 mg/day of prednisone for 1 month or longer, taking TNF- α antagonists)
- In addition, persons in the following high-risk groups should be considered for treatment of LTBI if their reaction to the Mantoux tuberculin skin test is greater than or equal to 10 mm:
- Recent arrivals (less than 5 years) from high-prevalence countries
 - Injection drug users
 - Residents and employees of high-risk congregate settings (e.g., correctional facilities, nursing homes, homeless shelters, hospitals, and other health care facilities)
 - Mycobacteriology laboratory personnel
 - Persons with clinical conditions that make them high risk
 - Children under 4 years of age, or children and adolescents exposed to adults in high-risk categories
- Because B.A. does not fall in to any of these categories, she would not be a candidate for preventive therapy, at this time.

PART 1 MEDICAL-SURGICAL CASES

12. According to the most current CDC guidelines, what constitutes usual preventive therapy for LTBI?

The preferred treatment regimen is the use of isoniazid (INH) for 9 months. Treatment must be modified if the patient is a contact of an individual with INH, multidrug-resistant TB, or is HIV positive. If the person is adherent to the isoniazid (INH) preventive therapy, it is highly effective in preventing latent TB infection from progressing to clinically apparent disease.

13. Different medications are associated with different side effects. Identify the test used to monitor each possible side effect listed as follows:

- | | |
|------------------------------------|---|
| ___A. Peripheral neuropathy | 1. Audiogram |
| ___B. Clinical hepatitis | 2. CBC (WBC and platelets) |
| ___C. Fever and bleeding problems | 3. Cr/BUN, Cr Cl (creatinine clearance) |
| ___D. Nephrotoxicity/renal failure | 4. AST/ALT |
| ___E. Hyperuricemia | 5. Physical exam and monofilament testing |
| ___F. Optic neuritis | 6. Red-green discrimination and visual acuity |
| ___G. Hearing neuritis | 7. Uric acid |

Answers: A. 5; B. 4; C. 2; D. 3; E. 7; F. 6; G. 1

Monofilament testing is used to test sensation in the lower extremities. Clinical hepatitis is associated with elevations in aspartate aminotransferase (AST) and alanine aminotransferase (ALT) with a positive hepatitis C virus (HCV). Upward deviations in the WBC may signal an inflammatory event that accompanies a fever, and alterations in the platelet count can identify patients at risk for altered coagulopathy. Elevations in creatinine and BUN with a decrease in creatinine clearance signify diminished renal function associated with nephrotoxicity and acute renal failure. Uric acid levels are monitored for elevations. Those with optic neuritis might have alterations in red-green discrimination and visual acuity. An audiogram is used as a diagnostic test for determining the degree and type of hearing loss and would be used to detect hearing neuritis.

14. Nonadherence to drug therapy is a major problem that leads to treatment failure, drug resistance, and continued spread of TB. The CDC recommends two methods to ensure compliance with medication for all patients who have drug-resistant TB and for those who take medication two or three times every week. Identify one of those methods.
- Direct observation therapy: A health care worker actually observes each patient take his or her medications.
 - Hospitalization until the tubercle bacilli is no longer identified in the sputum.
15. What information should B.A. receive before leaving the clinic?
- She should understand the S/S of active TB (in case her TB becomes active)—for example, fever, night sweats, fatigue, anorexia, and weight loss.
 - She should be told that she will always have a positive TB skin test because she has been exposed. The only way to determine whether she has active disease is by CXR.

CASE STUDY OUTCOME

B.A. is hired under the condition that she must immediately report any signs and symptoms of active disease to the county health department or her physician and have a yearly CXR.



Case Study 19 Atelectasis

Difficulty: Beginning

Setting: Hospital

Index Words: atelectasis, acute cholecystitis, chest x-ray (CXR), incentive spirometer (IS), medications, laboratory values, diagnostic tests, patient education, assessment, symptom management

► Scenario

M.N., age 40, was admitted with acute cholecystitis. After undergoing an open cholecystectomy, she is being admitted to your surgical floor. She has a nasogastric tube to continuous low wall suction, one peripheral IV, and a large abdominal dressing. Her orders are as follows:

■ Chart View

Physician's Orders

Progress diet to low-fat diet as tolerated
 D5 ½ NS with 40 mEq KCl at 125 mL/hr
 Turn, cough, and deep breathe q2h
 Incentive spirometer q2h while awake
 Dangle in AM, ambulate in PM
 Morphine sulfate 10 mg IM q4h prn for pain
 Ampicillin (Omnipen) 2 g IVPB q6h
 Chest x-ray in AM

- Are these orders appropriate for M.N.? State your rationale.
 - M.N. should not receive a diet order until she resumes bowel sounds and passes flatus. Then the nasogastric tube will be removed, and M.N. can start eating.
 - M.N. would be NPO. It usually takes 48 to 72 hours for the bowels to resume peristalsis after abdominal surgery.
 - Morphine sulfate should be given in small doses (1 to 2 mg) by IV more frequently (q1h prn). IM injections are both painful and unnecessary.
- What gastrointestinal complication might result from one of the medications listed in M.N.'s orders?

Morphine sulfate can result in constipation because of decreased peristalsis. As the stool sits in the colon, water is reabsorbed, thereby resulting in dry, hard stool. Any narcotic should be accompanied by a bowel management plan.

CASE STUDY PROGRESS

Four hours after admission, the nursing assistive personnel (NAP) reports to you the following:

■ Chart View

Vital Signs

Blood pressure	148/82 mm Hg
Heart rate	118 beats/min
Respiratory rate	24 breaths/min
Temperature	101° F (38.3°C)
Sao ₂	88%

- Based on her vital signs, what do you think could be happening with M.N., and why?
 - Her blood pressure, pulse, and respirations are high, perhaps because of incisional pain, fever (inflammatory process), or hypoxemia.
 - Temperature is elevated; this might be because of inflammatory response from infection (cholecystitis on admission) or a normal postoperative reaction.
 - Her Sao₂ is low: Incisional pain might cause splinting and shallow respirations, resulting in atelectasis and/or hypoxemia. She might also be developing pneumonia or an embolus.

- You know M.N. is at risk for postoperative pneumonia and atelectasis. What is atelectasis, and why is M.N. at risk?

Atelectasis is a collapsed or airless state of the lung, which might be acute or chronic and might involve all or part of the lung. Inadequate lung expansion is a primary cause of postoperative atelectasis. The effects of anesthesia, reluctance to cough and deep breathing resulting from inadequate pain control or location of the surgical incision, and immobility contribute to inadequate lung expansion.

- Describe the assessment you would need to perform to differentiate what might be occurring with M.N.

Common presenting symptoms of atelectasis are dyspnea and hypoxia, which might be accompanied by fever, crackles, or diminished or absent breath sounds. Postoperative pneumonia generally occurs after the third postoperative day. Although there are similar symptoms as atelectasis, in addition, those with pneumonia usually have a productive cough and pleuritic chest pain. Pulmonary embolism is another postoperative complication. Common signs and symptoms are tachypnea, anxiety, tachycardia, dyspnea, pleuritic chest pain, cyanosis, and hypoxia. Atelectasis after a pulmonary embolism typically does not occur until 24 hours later. A chest x-ray (CXR) is the best way to distinguish between atelectasis and pneumonia.

CASE STUDY PROGRESS

Knowing M.N.'s vital signs, you do an assessment and auscultate decreased breath sounds and crackles in the right base posteriorly. Her right middle and lower lobes percuss slightly dull. She splints her right side when attempting to take a deep breath. She does not have a productive cough, chest pain, or any anxiety. You suspect that she is developing atelectasis.

- Describe four actions you would take next in the next few hours.
 - Administer pain medication, and tell her that you are going to let her rest for 20 minutes until the morphine has time to take effect; then you will be back to help her cough and deep breathe.
 - Demonstrate cough and deep-breathing techniques. Show her how to use a pillow to splint her incision, and coach her while she coughs, dangles at the side of the bed, and walks around the room.
 - Explain and demonstrate the correct use of the incentive spirometer (IS). Have her use the IS every hour while awake.

- Reassess her vital signs every 2 hours and monitor for signs of deterioration.
 - Be prepared to call a physician if her condition worsens.
7. Outline nursing interventions that are used to prevent pulmonary complications in patients undergoing abdominal surgery.
- Administration of pain medications should be given as frequently as necessary during the immediate postoperative period.
 - Encouraging and assisting the patient to turn, cough, and deep breathe at least every 1 to 2 hours to minimize the risk for atelectasis and pneumonia.
 - Position changes and range-of-motion exercises are instituted immediately after surgery and carried out every 1 to 2 hours.
 - Ambulatory efforts generally are begun on the evening of surgery.
 - Fluids are administered as ordered to thin secretions.
8. To promote optimal oxygenation with M.N., which action(s) could you delegate to the NAP? (Select all that apply.)
- a. Reminding the patient to cough and deep breathe
 - b. Instructing the patient on the use of IS
 - c. Assisting the patient in getting up to the chair
 - d. Taking the patient's temperature and reporting elevations
 - e. Encouraging the patient to splint the incision
 - f. Auscultating the patient's lung sounds
- Answers: A, C, D, E
- To prevent pulmonary complications, patients should be encouraged to cough and deep breathe, ambulate as soon as possible, and splint the incision to minimize discomfort during activity. For patient safety, the nurse should enlist the assistance of other staff members, including NAP, during these efforts, while encouraging the patient to help. The NAP cannot instruct the patient on the use of the IS; teaching is the responsibility of the RN; however, the NAP could reinforce teaching provided by the RN. The NAP can take the patient's vital signs as long as the RN has given the NAP parameters that the NAP would need to report to the RN. Auscultating lung sounds is not within the scope of practice for the NAP.
9. Identify three outcomes that you expect for M.N. as a result of your interventions.
- Decreased resting respiratory rate
 - Increased breath sounds over the right lower lobe by auscultation
 - Crackles clearing or clear lung sounds
 - SaO_2 greater than 90%
 - Afebrile status
 - Resonant percussion
10. M.N.'s sister questions you, saying, "I don't understand. She came in here with a bad gallbladder. What has happened to her lungs?" How would you respond?
- The sister and perhaps M.N. are concerned that something might have gone wrong with M.N. during her hospitalization. They need to be reassured.
 - State everything in positive terms.
 - Inform them that M.N. was very sick when she was admitted and that her incision site is painful. Explain that you are giving M.N. pain medication so that she will be able to cough and breathe deeply, move around in bed, and walk so that she will not develop atelectasis or pneumonia.
 - Assure them that M.N. is recovering well from surgery.
 - Show M.N.'s sister how to help M.N. with ambulation and coughing.

PART 1 MEDICAL-SURGICAL CASES

- 11.** Despite your interventions, 4 hours later M.N. is not improved. Using SBAR, what would you report to the physician?

You would first need to identify yourself and the patient. Then, the nurse would describe the situation, focusing on the SpO_2 of 88% and describing the earlier assessment findings: 118, 24, 101° F, auscultated decreased breath sounds and crackles in the right base posteriorly, right middle and lower lobes percussed slightly dull, without productive cough, chest pain, or any anxiety. You state how many hours postoperative the patient is; review the interventions you performed, including pain medications given, ambulation efforts, and the use of IS and coughing and deep breathing; and review the current status of the patient. You would conclude your remarks with the belief that atelectasis is present and the recommendation that a CXR is needed.

- 12.** The physician orders a CXR. Radiology calls with a report, confirming that M.N. has atelectasis. Will that change anything that you have already planned for M.N.? Explain what you would do differently if M.N. had pneumonia.
- No. You should continue your plans and monitor effectiveness.
 - If M.N. had pneumonia, you would carry out the same plan and monitor the outcomes; the only thing that might change would be new antibiotics added to her treatment plan.



Case Study 20 Obstructive Sleep Apnea

Difficulty: Beginning

Setting: Clinic

Index Words: sleep apnea, symptoms, polysomnogram, sleep hygiene, continuous positive airway pressure (CPAP), CPAP with mask over mouth and nose (BiPAP), durable medical equipment (DME)

► Scenario

S.R. is a 69-year-old man who presents to the clinic because his “wife complains that his snoring is difficult to live with.”

1. As the clinic nurse, what routine information would you want to obtain from S.R.?

VS and O₂ saturation

Pertinent medical history: lung diseases such as asthma or emphysema, diabetes mellitus, hypothyroidism

Environmental factors: wood-burning stove, animals in the home (especially birds and cats)

Pertinent nasal problems: deviated septum, chronic sinusitis

Allergies: particularly airborne particles such as animal dander, dust mites, cockroach droppings

Medications he is currently taking: opioids, modafinil (Provigil), amphetamines (prescribed and illegal), OTC drugs, and herbals

CASE STUDY PROGRESS

After interviewing S.R., you note the following: S.R. is under considerable stress. He owns his own business. The stress of overseeing his employees, meeting deadlines, and carrying out negotiations has led to poor sleep habits. He sleeps 3 to 4 hours per night. He keeps himself going by drinking 2 quarts of coffee and smoking three to four packs of cigarettes per day. He has gained 50 pounds over the past year, leading to a current weight of 280 pounds. He complains of difficulty staying awake, wakes up with headaches on most mornings, and has midmorning somnolence. He states that he is depressed and irritable most of the time and reports difficulty concentrating and learning new things. He has been involved in three auto accidents in the past year.

S.R.'s vital signs are BP of 164/90, pulse of 92 beats/min, 18 breaths/min with Sao₂ 90% on room air. His examination is normal, except for multiple bruises over the right ribcage. You inquire about the bruises, and S.R. reports that his wife jabs him with her elbow several times every night. In her own defense, the wife states, “Well, he stops breathing and I get worried, so I jab him to make him start breathing again. If I don't jab him, I find myself listening for his next breath and I can't go to sleep.” You suspect sleep apnea.

2. Identify two of the main types of apnea, and explain the pathology of each.

Central sleep apnea: This type of apnea is less common and occurs when the brain fails to send the appropriate signals to the inspiratory muscles to initiate respiration. There is no respiratory effort.

Obstructive sleep apnea (OSA): This type of apnea is more common and is due to the obstruction and/or collapse of the tongue, uvula, and soft palate, forming a tight blockage that prevents air from entering the lungs. Respiratory effort continues despite lack of airflow—this is an apnea event. The actual cause of OSA is unknown, but sleep apnea is a potentially life-threatening condition. Early recognition and treatment are important because the long-term consequences of sleep apnea include MI, high BP (HTN), and arrhythmias. If it continues over a prolonged period, it can lead to pulmonary HTN and right-sided HF, polycythemia, and CVA. Although the mechanism is unknown, uncontrolled DM has been associated with apnea; conversely, controlling DM has been shown to control OSA.

PART 1 MEDICAL-SURGICAL CASES

3. Identify at least five signs or symptoms of obstructive sleep apnea (OSA), and star those symptoms that S.R. is experiencing.
 - Cessation of respiration during sleep usually followed by gasping for breath*
 - Excessive daytime somnolence or fatigue*
 - Reports of “not feeling rested” in the morning*
 - Memory loss*
 - Poor judgment
 - Lethargy
 - High BP*
 - Confusion
 - Headache*
 - Weight gain*

4. What tests help the provider diagnose OSA?
 - Physical examination of the upper airway is performed.
 - Overnight screening oximetry test is done to determine whether the patient desaturates during sleep.
 - Polysomnogram is the gold standard for diagnosis, and it is often done if desaturation is detected during overnight screening oximetry.
 - Many insurance companies are authorizing limited channel monitoring to define and treat OSA. The polysomnogram is reserved for more complicated cases.
 - Portable sleep study in the home setting might also be used.

5. S.R. and his wife ask why it is so important to determine whether or not S.R. has OSA. You would tell them that properly diagnosing OSA is important because effective treatment is necessary to prevent which common complications of OSA? (Select all that apply.)
 - a. Stroke
 - b. Early onset of chronic obstructive pulmonary disease (COPD)
 - c. Hypotension
 - d. Right-sided heart failure
 - e. Cardiac dysrhythmias

Answers: A, D, E

Complications that can result from untreated sleep apnea include cardiovascular changes, such as hypertension, right-sided heart failure from pulmonary hypertension caused by chronic nocturnal hypoxemia, cardiac dysrhythmias, as well as an increased risk of stroke and insulin resistance. Untreated OSA does not lead to hypotension or an early onset of COPD.

CASE STUDY PROGRESS

The primary care provider (PCP) examined S.R. and documented a long soft palate, recessed mandible, and medium-sized tonsils. S.R.'s overnight screening oximetry study showed 143 episodes of desaturation ranging from 68% to 76%; episodes of apnea were also documented. He was diagnosed with OSA with hypoxemia, and a full sleep study is ordered.

6. S.R. and his wife ask about a full sleep study. How would you explain a polysomnogram to them?

A polysomnogram will determine the depth and type of sleep, as well as how well you are breathing during sleep. The test will take place in a sleep laboratory; a sleep technician will monitor you throughout the night. Your chest and abdominal movement, oral airflow, nasal airflow, Sp_o₂, ocular movement, and heart rate and rhythm will be monitored. All of this monitoring will require that several wires be taped to your head and face. Although the testing will not be painful, you might find it difficult to sleep with all of the equipment attached to you and in the unfamiliar environment of the laboratory.

7. The PCP asks you to counsel S.R. about lifestyle changes that he could make immediately to help with his situation. Name four topics you would address with S.R.
- **Begin efforts to lose weight.** He could immediately begin a walking program and start an appropriate diet.
 - **Abstain from alcohol.**
 - **Avoid back sleeping.** He can sew a pouch in the back of a nightshirt and put tennis balls in it, so he is less likely to sleep on his back.
 - **Avoid opioids, benzodiazepines, muscle relaxants.**
 - **Elevate the head of bed (HOB).**
 - **Initiate smoking cessation efforts.** He can enroll in a smoking cessation program, use nicotine patches, gum, or a prescription for bupropion (Zyban) to help him stop smoking.
 - **Decrease caffeine intake.** He can start mixing his coffee with decaffeinated coffee to decrease the caffeine.

CASE STUDY PROGRESS

S.R. returns for a follow-up visit after being diagnosed with OSA. He reports that he has lost 10 pounds, but there has been little improvement in his symptoms. He states that he fell asleep while driving to work and wrecked his car. He wants to discuss further treatment options.

8. What are the treatment options for OSA? Describe each.

Appliances: Mild OSA can be treated using dental appliances that move and hold the mandible in a forward position.

Continuous positive airway pressure (CPAP): A machine generates a continuous flow of air to the upper airways throughout the respiratory cycle. The airflow is delivered with sufficient pressure to prevent the upper airway from collapsing during inspiration. This method can be used through a ventilator, endotracheal tube, nasal pillow, nasal mask, or full face mask.

CPAP with O₂: This is the same as CPAP but with added O₂ through the machine or by nasal cannula. This method can be used with a nasal pillow, nasal mask, or full face mask.

BiPAP: The mask fits over both the mouth and nose.

SURGICAL OPTIONS

Tonsillectomy, with or without adenoidectomy, or a uvulopalatopharyngoplasty (UPPP) (the removal of the uvula, part of the soft palate, and mucosa of the pharynx) might be done to enlarge the throat. Reports of success vary widely, from 40% to 80%.

Mandibular advancement surgery for the congenital small mandible can be performed.

Tracheostomy: This surgical procedure creates an artificial opening into the trachea from the neck. The patient places a cap over the opening during the day, allowing the patient to breathe and speak normally. The patient connects himself or herself to humidified O₂ at night, thereby bypassing any upper airway obstruction. This treatment option is reserved for life-threatening sleep apnea.

Bariatric surgery might be considered in the efforts to facilitate weight loss, therefore improving symptoms of OSA.

CASE STUDY PROGRESS

S.R. and the PCP decide on the least invasive treatment—continuous positive airway pressure (CPAP). The provider writes a prescription for CPAP. The patient has a choice of which durable medical equipment company he wants to get his equipment from. You help him by giving him the names of three reputable companies and advise him to call his insurance company to find out how much they will pay and how much he will be responsible for.

PART 1 MEDICAL-SURGICAL CASES

9. S.R. calls in 2 weeks with complaints of dry nasal membranes, nosebleeds, and sores behind his ears. What advice would you give S.R.?
- Instruct him to ask the DME company to check the mask and tubing to make sure they are fitting properly.
 - Instruct him to ask the company to add humidification to his O₂.
 - Get saline nasal spray at any drugstore or make your own. Use two sprays in each nostril up to q2h prn. A recipe for ocean saline spray: Boil water 20 minutes and let cool. Then to 1 quart water, add 1 tsp salt, plus a pinch of baking soda. Store at room temperature in a covered container for up to 72 hours, then discard.
 - Teach S.R. how to pad and protect the skin behind his ears.
 - Have him gently cleanse the nares every 8 hours with a cotton-tipped applicator moistened with saline.



Case Study 21 Asthma

Difficulty: Beginning**Setting:** Outpatient clinic**Index Words:** asthma, allergies, respiratory distress, patient education, assessment, aerosol treatment, inhaler

► Scenario

B.T., a 22-year-old man who lives in a small mountain town in Colorado, is highly allergic to dust and pollen. B.T.'s wife drove him to the clinic when his wheezing was unresponsive to fluticasone/salmeterol (Advair) and ipratropium bromide (Atrovent) inhalers, he was unable to lie down, and he began to use accessory muscles to breathe. B.T. is started on 4 L oxygen by nasal cannula and an IV of D5W at 15 mL/hr. He appears anxious and says that he is short of breath.

■ Chart View

Vital Signs

Blood pressure	152/84 mm Hg
Pulse rate	124 beats/min
Respiratory rate	42 breaths/min
Temperature	100.4° F (38.4° C)

1. Are B.T.'s vital signs (VS) acceptable? State your rationale.

No. His systolic blood pressure is too high (152 mm Hg), he is tachycardic (124 beats/min) and tachypneic (42 breaths/min), and his temperature is elevated at 100.4° F. B.T. is anxious and experiencing shortness of breath. His respiratory muscles are working hard to breathe, thereby increasing his metabolic rate, temperature, and stress.

2. What is the pathophysiology of asthma?

The primary pathophysiologic process in asthma is chronic inflammation, which leads to airway hyperresponsiveness or hyperreactivity and acute airflow limitation. Asthma begins with exposure to allergens or irritants that initiates the inflammatory cascade. As the inflammatory process begins, mast cells beneath the basement membrane of the bronchial wall degrade and release multiple inflammatory mediators. Some of these inflammatory mediators have effects on the blood vessels, causing vasodilation and increasing capillary permeability. The effects of others include vascular congestion; edema formation; production of thick, tenacious mucus that fills the airway and inhibits the movement of air; bronchial muscle spasm; and thickening of airway walls. The increased swelling of tissue makes it more difficult to expand lungs with inspiration and results in decreased lung compliance. Impaired mucociliary function occurs as the increased mucus production covers cilia and inhibits their sweeping motion.

3. How is asthma categorized? Describe the characteristics of each classification.

Asthma can be classified according to the frequency and severity of symptoms, the pattern of airflow limitation, and the treatment steps necessary to decrease symptoms or prevent exacerbations.

Mild Intermittent

Symptoms occur twice weekly or less.

PART 1 MEDICAL-SURGICAL CASES

Patient is asymptomatic between exacerbations.
 Exacerbations are brief (hours to days).
 Intensity of exacerbations varies.
 Nocturnal symptoms occur twice a month or less.

Mild Persistent

Symptoms occur more frequently than twice weekly but less often than once daily.
 Exacerbations might affect activity.
 Nocturnal symptoms occur more frequently than twice a month.

Moderate Persistent

Daily symptoms occur.
 Daily use of inhaled short-acting beta agonist is needed.
 Exacerbations affect activity.
 Exacerbations occur at least twice weekly and might last for days.
 Nocturnal symptoms occur more frequently than once weekly.

Severe Persistent

Symptoms are continuous.
 Physical activity requires limitations.
 Frequent exacerbations occur.
 Nocturnal symptoms occur frequently.

■ **Chart View****Arterial Blood Gases**

pH	7.31
Paco ₂	48 mm Hg
HCO ₃	26 mmol/L
Pao ₂	55 mm Hg
Sao ₂	88%

- Interpret B.T.'s arterial blood gas results.
 B.T.'s pH indicates that he is acidotic. His Paco₂ level is high which indicates that he is retaining carbon dioxide, consistent with poor respiratory function. This means B.T. has respiratory acidosis. His bicarbonate level is within normal limits. B.T. lives at high altitude. Although his Pao₂ will be decreased at this altitude, his Sao₂ should be above 90%; the 88% Sao₂ and the Pao₂ 55 indicate hypoxemia related to the asthma attack is at a level that could indicate impending respiratory failure.
- What is the rationale for immediately starting B.T. on O₂?
 Bronchoconstriction has caused an increase in airway resistance and a decrease in tidal volume (V_T). The goal of therapy is to compensate by increasing the concentration of inspired O₂.
- You will need to monitor B.T. closely for the next few hours. Identify four signs and symptoms of impending respiratory failure that you will be assessing for.
 - Breathlessness at rest
 - Muteness
 - Inability to recline
 - Respiratory rate greater than 30 breaths/min
 - Paradoxical thoracoabdominal movement
 - Few or absent breath sounds

- Relative bradycardia
- Absent pulsus paradoxus
- Peak expiratory flow (PEF) less than 50% predicted
- PaCO₂ greater than 42 mm Hg

■ Chart View

Medication Orders

Albuterol 2.5 mg plus ipratropium 250 mcg nebulizer treatment STAT
 Albuterol (Ventolin) inhaler 2 puffs q4h
 Metaproterenol sulfate (Alupent) 0.4% nebulizer treatment q3h
 Fluticasone (Flovent) 250 mcg by MDI twice daily

7. What is the rationale for the albuterol 2.5 mg plus ipratropium 250 mcg nebulizer treatment STAT (immediately)?
 Albuterol (e.g., Ventolin, Proventil) is a fast-acting, beta-2 agonist that acts to relax and open airways and increase ciliary movement to help clear secretions. It may cause shakiness, nervousness, tachycardia, and/or increased BP, so B.T. should be closely monitored. Ipratropium is an anticholinergic that causes bronchodilation and inhibits secretions without causing systemic anticholinergic effects. The combination is more effective than either drug alone.
8. Identify the drug classification and expected outcomes B.T. should experience through using metaproterenol sulfate (Alupent) and Fluticasone (Flovent).
 Metaproterenol sulfate is a short acting beta-2 receptor adrenergic bronchodilator. It is used to reverse airway constriction caused by acute and chronic bronchial asthma. It has a rapid onset (a few minutes) and is used to treat acute bronchospasm. During acute exacerbations, it can be used every 3 to 4 hours. Fluticasone (Flovent), an inhaled corticosteroid, is used to control the inflammatory response that is believed to be a cause of asthma. It is often used concurrently with bronchodilators, primarily beta-adrenergic agonists. Flovent is typically taken twice daily. The use of this combination should result in reducing swelling, mucus production, and spasm in/of the airways resulting in the easing of airway constriction.
9. B.T. stated he had taken his Advair that morning, then again when he started to feel short of breath. Is fluticasone/salmeterol (Advair) appropriate for use during an acute asthma attack? Explain.
 No, it is not a fast-acting medication and is not appropriate for the relief of acute shortness of breath. An Advair inhaler contains two medications: It is a combination of a low-dose inhaled steroid (fluticasone) that decreases the inflammation of the airways and a long-acting beta agonist (salmeterol) that acts as a bronchodilator. This pairing is useful in reducing swelling, mucus production, and spasm in/of the airways. For Advair to be most effective, it needs to be used regularly.
10. What are your responsibilities while administering aerosol therapy?
 A major nursing responsibility during aerosol therapy is to assess the effectiveness of the treatment, the patient's tolerance of the procedure, and the patient's ability to perform the procedure and to use equipment correctly. Assess breath sounds, work of breathing, and pulse oximetry readings and heart rate before and after treatments. After breathing treatments, you need to assist the patient with performing oral hygiene.

PART 1 MEDICAL-SURGICAL CASES

- 11.** When combination inhalation aerosols are prescribed without specific instructions for the sequence of administration, you need to be aware of the proper recommendations for drug administration. What is the correct sequence for administering B.T.'s treatments?
Whenever a beta-agonist (Alupent) is prescribed, the beta-agonist is always administered first, with a 5-minute wait before administration of the second drug. Therefore, the fluticasone (Flovent) should be given 5 minutes after the albuterol (Ventolin). Do not administer separate aerosols in rapid sequence because there is the possibility of inducing fluorocarbon toxicity, and there is a decreased effectiveness of both drugs.
- 12.** List five independent nursing interventions that may help relieve B.T.'s symptoms.
- Remove or loosen constrictive clothing.
 - Promote a quiet environment with minimal stimulation.
 - Elevate the head of the bed or have B.T. sit in a chair to promote maximum lung expansion.
 - Hydration will help thin pulmonary secretions and facilitate expectoration. This can be achieved by encouraging PO fluids.
 - Coach B.T. to cough effectively to facilitate airway clearance.
 - Coach B.T. in pursed-lip breathing to increase pressure throughout the airways and facilitate expiration.

CASE STUDY PROGRESS

After several hours of IV and PO rehydration and aerosol treatments, B.T.'s wheezing and chest tightness resolve, and he is able to expectorate his secretions. The physician discusses B.T.'s asthma management with him; B.T. says he has had several asthma attacks over the last few weeks. The physician discharges B.T. with a prescription for oral steroid "burst" (prednisone 40 mg/day \times 5 days), fluticasone/salmeterol (Advair) 100/50 mcg two puffs twice daily, albuterol (Proventil) metered-dose inhaler (MDI) two puffs q6h as needed using a spacer, and montelukast (Singulair) 10 mg daily each evening. He recommends that B.T. call the pulmonary clinic for follow-up with a pulmonary specialist.

- 13.** What is the rationale for B.T. being on the oral steroid "burst"?
- Glucocorticoids reduce symptoms of asthma by suppressing inflammation. Specific anti-inflammatory effects include decreased edema of the airway mucosa; decreased synthesis and release of inflammatory mediators; and decreased infiltration and activity of inflammatory cells, including eosinophils and leukocytes. By suppressing inflammation, glucocorticoids reduce bronchial hyperreactivity. In addition to reducing inflammation, glucocorticoids decrease airway mucus production and increase the number of bronchial beta-2 receptors, as well as their responsiveness to beta-2 agonists.
- 14.** What issues will you address in discharge teaching with B.T.?
- Have his wife join him before giving B.T. any instructions.
 - Review and reinforce the information given by the physician for the benefit of B.T. and his wife. The physician told B.T. that his inhalers are OK for day-to-day control, but they act slowly and are not adequate to open his airways during an asthma attack. The physician gave B.T. a prescription for a fast-acting inhaler to help him open his airways and advised him to see a pulmonary specialist in the clinic.
 - Help B.T. and his wife make the pulmonary clinic appointment.
 - Educate the patient and wife on medications, dosage, and use, stressing which medications are used for acute attacks.
 - Demonstrate both MDI/spacer and peak flow techniques.
 - Have a written plan for exacerbations.
 - Have B.T. keep a journal to identify triggers (heat, humidity, cold, dry air, dust, animal dander, different pollens, perfumes, etc.). Once the patient is aware of the diagnosis, triggers become more evident.

CASE STUDY PROGRESS

You ask B.T. to demonstrate the use of his MDI. He vigorously shakes the canister, holds the aerosolizer at an angle (pointing toward his cheek) in front of his mouth, and squeezes the canister as he takes a quick, deep breath.

15. What common mistakes has B.T. made when using the inhaler?
 - Not using the spacer
 - Inhaling too fast (he should take a slow, deep breath)
 - Lack of coordination between activating the inhaler and initiating the deep breath
 - Angling the inhaler to spray the tongue or side of the mouth
 - Failing to hold his breath for 10 seconds after inhalation
 - Failing to clean the inhaler after each use, which results in crystallization of medication around orifice and failure to deliver entire dose
 - Failing to rinse mouth after using steroid inhalers, which can result in a *Candida albicans* infection in the oropharynx

16. What would you teach B.T. about the use of his MDI?
 - Instruct him in the use of the spacer (such as an Aerochamber). Research shows that spacers let patients get more medicine, and they don't have to worry about timing their breath with the discharge of the canister. If he is someplace and does not have a spacer, have him open his mouth wide, hold the MDI 1 inch from his lips, and spray during a deep inhalation (acts like a carburetor).
 - Remind him to hold his deep breath for 10 seconds before breathing out.
 - Instruct him to clean the MDI and spacer in warm water and place them on a paper towel to air dry. This should be done daily.
 - Instruct him to rinse his mouth with water after each use of inhaled corticosteroids

17. B.T.'s wife asks about the possibility of B.T. having another attack. How would you respond?
 - "Yes, it is very likely that B.T. will have another asthma attack in the future."
 - "B.T. should become aware of triggers that seem to precipitate an exacerbation. He should keep an asthma diary and be prepared to avoid these triggers or appropriately treat the triggers. Management of asthma is the goal."
 - "Pulmonary physicians specialize in pulmonary problems, such as asthma, and are knowledgeable about the latest treatments and drug therapy."

18. B.T. states he would like to read more about asthma on the Internet. List three credible websites you could give him.

Credible websites include those maintained by the National Institutes of Health (www.nlm.nih.gov); Asthma and Allergy Foundation of America (www.aafa.org); National Library of Medicine (www.nlm.nih.gov/medlineplus/asthma.html); and the Centers for Disease Control and Prevention (www.cdc.gov/asthma).



Case Study 22 Asthma

Difficulty: Intermediate

Setting: Outpatient clinic

Index Words: asthma, exercise-induced asthma assessment, peak flow meter (PFM), medications, patient education, symptom management

► Scenario

L.B. is a 30-year-old secretary who is being seen in the clinic with 6 weeks of a dry, hacking cough after recovering from bronchitis this winter. The cough is worse at night and associated with shortness of breath. In the past, she has experienced coughing spells after running a 5 K race. She has hay fever that seems to be year-round and has eczema in the winter. Both of her children and her maternal grandmother have asthma.

- As the intake nurse, what routine information do you want to obtain from L.B.?
 - VS, including oximetry
 - Personal and family history
 - Medications
 - Allergies, skin conditions
 - Description of her symptoms: location, quality, quantity, timing, setting, factors that aggravate or relieve, associated symptoms
 - Whether she has ever experienced these symptoms before
- L.B.'s chief complaint is a cough. What are the main causes of chronic cough, and what questions should you ask to elicit information about each cause?
 - Asthma**
 - Do you have a history of asthma?
 - Do you ever experience musical breathing or wheezing?
 - Do you experience chest tightness or SOB?
 - Is your cough brought on by exercising, high pollen counts, cold air, laughing, or illness?
 - Postnasal Drip**
 - Do you have allergies or sinus problems?
 - Do you have chronic drainage down the back of your throat?
 - Do you have a tickle in your throat?
 - Do you clear your throat a lot?
 - Gastroesophageal Reflux Disease**
 - Do you experience acid reflux (does stomach acid come up into your throat)?
 - Is the heartburn worse after you eat certain foods or beverages, go to bed within 4 hours of eating a meal, exercise too soon after eating, or overeat?
 - How often do you take antacids or some type of stomach medication?
 - Do the antacids help your cough?
 - Smoking**
 - Have you ever smoked?
 - Do you currently smoke?
 - How many packs did you smoke, and how many years have you smoked?

PART 1 MEDICAL-SURGICAL CASES

Chronic Bronchitis

- How long have you had this cough?
- Do you cough up anything?
- Have you had a productive cough at least 3 months of the year for 2 consecutive years?

Medication Induced

- What medications do you take?
- Did your cough begin after starting any medication?

Post-Respiratory Infection

- Did your cough begin during a respiratory infection?

CASE STUDY PROGRESS

L.B. denies symptoms in answers to all of your questions except those given in the initial interview. She is not taking any medication other than a multiple vitamin.

3. What would you include in your physical examination, and why?

VS: Carefully note respiratory effort, respiratory rate, and oximetry.

ENT: There is a close correlation between asthma and allergic rhinitis; inadequately controlled allergic rhinitis correlates with uncontrolled asthma. Findings for allergic rhinitis are pale, boggy turbinates and serous otitis with or without mucous drainage in the posterior pharynx.

Lung sounds: Often wheezing is heard, but breath sounds may be clear; if the patient's airways are very constricted, treatment with a beta agonist may relax the airways enough to hear wheezing. Patients with COPD often have distant breath sounds; patients with pneumonia may have crackles, wheezes, and egophony.

Abdominal palpation: Look for gastric tenderness that often accompanies GERD. GERD is another trigger for asthma. L.B. reported increased cough at night.

Skin: Eczema can be an atopic manifestation of asthma.

CASE STUDY PROGRESS

L.B. was not in acute distress. Vital signs were 110/60, 55, 18. She had no sinus tenderness, ears were negative, nasal mucosa was pale and boggy, mouth was negative, there was no cervical adenopathy, and lungs were clear to auscultation. Forced expiration using the peak flow meter (PFM) generated a cough. Her peak flow was 350 L/min with good effort. Expected peak flow for her height and age is 512 L/min, giving a response of 68% of predicted.

4. The provider orders a predilator and postdilator pulmonary function test (PFT). What is the purpose of completing the PFTs predilator and postdilator?

PFTs are performed initially, then 15 minutes after inhalation of a beta agonist. This is called a "pre-post dilator study" and is meant to determine whether a person has asthma. If L.B. has asthma, the postdilator maneuver will show more than 15% improvement in airflow.

5. The diagnosis of asthma is confirmed, and L.B. returns to the clinic for asthma education. What topics will you address?

- Educate the patient that asthma is a controllable disease.
- Explain what each medication is and why she is taking it.
- Demonstrate PFM and MDI technique and ask for a return demonstration.
- Encourage the patient to keep a journal to identify and treat triggers. The patient needs to track seasonal symptoms and symptoms related to temperature, humidity, dust, animal dander, pollen, perfume, etc. Once the patient is aware of the diagnosis, the triggers become more evident.
- Make certain she has a written plan to treat exacerbations and knows when to seek emergency assistance.

6. What is a PFM? Give L.B. precise instructions to perform the PFM maneuver.
 PFM is a hand-held device that measures the maximum flow rate that can be generated when an individual takes a maximum inspiration then expels the volume with a maximum expiratory effort through the PFM device.
 Breathe in as deeply as you can, place the PFM in your mouth, and blow as hard and fast as you can, then record the reading. Repeat two times for a total of three measurements. Remembering that the PFM reading is effort dependent, it is important for the readings to be within 5% of each other. If one reading is much smaller than the other two, it should be discarded and another reading taken.
 A decreased PEFR indicates airway obstruction. The maneuver requires a consistent maximal effort on the part of the individual being tested.
7. L.B. asks why she has to use the PFM. Explain the purpose of the peak expiratory flow rate (PEFR) measurement and what role it plays in L.B.'s self-management of her asthma.
 The PEFR, measured in liters per minute, indicates the presence or absence of airflow obstruction. Normal PEFRs are based on height, age, and gender. PEFRs are used to monitor the effect of medication and can detect a worsening condition before symptoms are apparent to the individual. PEFR should be completed bid before and after inhaled medications for 2 weeks to develop a personal best or goal. The provider then calculates 80% and 50% of the patient's personal best and marks the meter with a green zone (which equals 80% to 100% of the personal best), yellow zone (50% to 79%), and red zone (below 50%). Readings in the green zone indicate that the patient is OK and may continue with daily activities. Readings in the yellow zone indicate that the patient is having a moderate asthma attack and should follow the plan for increasing the flow rate to the green zone. Readings in the red zone indicate the patient is having a severe asthma attack and should seek immediate medical assistance. It is important that each patient has a care plan to address what to do if the readings fall in the yellow or red zones.
8. The provider ordered triamcinolone (Azmacort) two puffs bid and albuterol (Ventolin) two puffs q6h prn. What points will you include when teaching L.B. about her medications?
 Asthma is an inflammatory disease, and triamcinolone is an anti-inflammatory drug. The goal of treatment for mild asthma is to identify triggers, control inflammation with an anti-inflammatory, and control secondary wheezing with a beta-2 agonist (albuterol). Albuterol is a bronchodilator that relaxes smooth muscles around the large airways. The albuterol MDI has fewer side effects than oral medication, but she might experience some anxiety, heart palpitations, or slight tremors. These symptoms can be worse if the MDI is not used correctly.
9. L.B. asks, "Why do I have to use this inhaler? Can't I just take some different pills?" Your response to L.B. is based on the knowledge that the inhalation route is:
- Safer and more effective than pills
 - Less expensive than combination therapy
 - Easier to master than oral therapy
 - More likely to assist in curing her asthma
- Answer: A
 Because using the inhaled route delivers the drug directly to the lungs, lower drug doses are possible, and there are fewer systemic side effects. Unfortunately, there is considerable expense involved with some inhalers, and more manual dexterity is required to master an inhaler or other devices. Any medication currently prescribed for asthma is used to control symptoms; they are not curative.
10. You instruct L.B. in the proper use of the metered-dose inhaler (MDI) using a spacer. How would you explain proper MDI use?
- Remove the protective cap from the inhaler, shake well, and insert the inhaler into the back of the spacer.
 - Breathe out normally, put the opening of the spacer in your mouth, and close your lips around it.

PART 1 MEDICAL-SURGICAL CASES

- Spray one puff into the spacer, then slowly breathe in as deeply as you can over a period of 3 or 4 seconds (the spacer will whistle or make a musical sound if you breathe in too quickly).
- Remove the spacer from your mouth, and hold your breath for 10 seconds, then exhale.
- Wait 1 minute between puffs.

11. Because L.B. is taking two puffs twice daily of triamcinolone (Azmacort), how long should the inhaler last? The canister label states that it contains 200 inhalations.

Answer: 50 days

An inhaler typically has 200 inhalations: At $200/4 (2 \times 2) = 50$ days.

The ordered dose is two puffs two times a day. The canister has a total of 200 puffs. You complete the following calculations to determine how long the MDI will last:

$$2 \text{ puffs} \times 2 \text{ times a day} = 4 \text{ puffs per day}$$

$$200 \text{ puffs} \div 4 \text{ puffs per day} = 50 \text{ days}$$

12. What will you teach L.B. to do if her PEFr value falls?

If the PEFr is within the yellow zone, it indicates caution. Something is triggering the patient's asthma, such as a cold or infection. A temporary increase in medications, such as using a beta-2-adrenergic agonist inhaler more frequently, might be needed.

If the PEFr is in the red zone, it indicates a serious problem and action must be taken. A typical rescue plan consists of two to four puffs of a short-acting inhaled beta-2-adrenergic agonist for up to three treatments at 20-minute intervals or a single nebulizer treatment. The patient needs to contact or be seen by the health care provider. Depending on symptoms, oral corticosteroids may be indicated.

13. You would recognize the need for additional teaching if L.B. says: (Select all that apply.)
- “I will use the albuterol inhaler thirty minutes before exercising.”
 - “My husband needs to know what to do in case I have an attack.”
 - “I will keep a diary of all of my PEFr measures.”
 - “I will place a plastic cover on our mattress and my pillows.”
 - “The bed linens need to be washed in cold water to reduce dust mites.”

Answer: A, E

The treatment of asthma is aimed at avoiding known allergens and respiratory irritants and controlling symptoms and airway inflammation. Beta-2-adrenergic agonists are most successful at maintaining bronchodilation during exercise when they are inhaled 10 to 20 minutes before exercise. Bedding should be washed in hot water to reduce or destroy dust mites. A family member or significant other should be taught what can be done to help the patient during an asthmatic attack. This person should know where the patient's inhalers, oral medications, and emergency phone numbers are located. The significant other can also be instructed on how to decrease the patient's anxiety if an asthma attack occurs. All PEFrs should be written down in a journal that should be brought to each visit with the health care provider.

CASE STUDY OUTCOME

During a follow-up visit, L.B.'s asthma is listed as mild persistent asthma. Her peak flow on the albuterol (Ventolin) and triamcinolone (Azmacort) has increased to 450L/min, which is 88% of the predicted; her cough has subsided, and she can again participate in sports without problems. There is no nighttime awakening, no loss of work, and no emergency department visits. She can demonstrate appropriate inhaler technique and has her completed peak flow diary with her.



Case Study 23 Community-Acquired Pneumonia

Difficulty: Intermediate

Setting: Hospital

Index Words: pneumonia, assessment, laboratory values, medications, diagnostic tests

► Scenario

The sister of C.K. brought her 71-year-old brother to the primary care clinic after he came down with a fever 2 days ago. She said he has shaking chills, a productive cough, and he can't lie down to sleep because "he can't stop coughing." After C.K. is examined, he is diagnosed with community-acquired pneumonia (CAP) and admitted to your floor. The intern is busy and asks you to complete your routine admission assessment and call her with your findings.

1. Identify the four most important things to include in your assessment.
 - Obtain complete VS with SaO_2 on room air.
 - Perform a full physical assessment, especially a cardiovascular and pulmonary assessment.
 - Ask about medication and drug allergies.
 - Question the patient about presence of pain or discomfort.
 - Determine nutritional status and fluid intake.
 - Determine a previous history (Hx) of pneumonia, pneumococcal polyvalent vaccine (Pneumovax), yearly flu vaccine.

CASE STUDY PROGRESS

Your assessment findings are as follows: C.K.'s vital signs are 154/82, 105, 32, 103° F (39.4° C), SaO_2 84% on room air. You auscultate decreased breath sounds in the left lower lobe anteriorly and posteriorly and hear coarse crackles in the left upper lobe. His nail beds are dusky on fingers and toes. He has cough productive of rust-colored sputum and complains of pain in the left side of his chest when he coughs. C.K. seems to be well nourished and adequately hydrated. He is a lifetime nonsmoker. Past medical history includes coronary artery disease and myocardial infarction (MI) with a stent; he is currently on metoprolol (Lopressor), amlodipine (Norvasc), lisinopril (Zestril), and furosemide (Lasix); for his type 2 diabetes mellitus, he is also taking metformin (Glucophage) and rosiglitazone (Avandia). He has never gotten the Pneumovax or flu shot. He does report getting "hives" when he took "an antibiotic pill" a few years ago but doesn't remember the name of the antibiotic.

2. Which of these assessment findings concern you? State your rationale.
 - C.K.'s pulse, respirations, and temperature are elevated; SaO_2 indicates hypoxemia if Hgb and Hct are normal.
 - Decreased breath sounds in the LLL and crackles in the LUL may indicate fluid accumulation or atelectasis.
 - Dusky nail beds indicate lack of O_2 uptake by the tissues.
 - Rust-colored sputum indicates blood and probable infection.
 - Pain with coughing is consistent with inflammation and/or infection.
 - Allergy to antibiotics: Try to find out whether he knows which one because, with his pulmonary infection, he will be started on an antibiotic.
 - The presence of comorbidities (CAD, MI, and DM) increases his mortality risk.

■ Chart View

Physician's Orders

2100-Calorie ADA diet
 VS with temperature q2h
 IV of D5 ½ NS at 125 mL/hr
 Ceftriaxone (Rocephin) 1 g IV bid
 Metaproterenol sulfate (Alupent) 0.4% nebulizer treatment q3h
 Titrate O₂ to maintain Sao₂ over 90%
 Obtain sputum for C&S
 Blood cultures for temperature over 102° F (38.9° C)
 CBC with differential and basic metabolic panel
 Urinalysis (UA) with C&S
 Chest x-ray (CXR) now and in the morning

3. Review the orders and outline a plan of what you need to do in the next 2 to 3 hours.
 The patient has a fever of 103° F (39.4° C). Start O₂, administer the Alupent treatment, order STAT CXR and blood cultures, and try to get the first sputum specimen and UA before beginning the antibiotic. Obtain admission blood work; start the IV fluids, and then repeat vital signs.
4. Is the IV fluid of D5 ½ NS appropriate for C.K.? State your rationale.
 D5 ½ NS is considered a “hydrating fluid.” Solutions consisting of dextrose with hypotonic saline provide more water than is required for excretion of salt. C.K. has an infection and will need hydration to help the body dispose of the infectious toxins and wastes. The rate of 125 mL/hr is considered adequate for maintenance of normal fluid balance. However, because the solution contains dextrose and C.K. is a type II diabetic, he will require frequent monitoring of his blood glucose levels because the use of this solution might raise blood glucose levels.
5. What is the rationale for ordering O₂ to maintain Sao₂ over 90%?
 The order means that you are to titrate the O₂ flow rate to maintain the saturation reading on C.K.'s oximeter (Sao₂) above 90%. According to the oxyhemoglobin dissociation curve, a Hgb saturation of 90% (Sao₂ of 90%) means that the partial pressure of O₂ in the arterial blood (Pao₂) is approximately 60 mm Hg (remember that normal Pao₂ at sea level is 80 to 100 mm Hg). Below this point on the curve, the slope becomes very steep, which means that small decreases in Hgb saturation reflect larger decreases in Pao₂ (e.g., Sao₂ of 85% reflects a Pao₂ of 50 mm Hg; Sao₂ of 80% means the Pao₂ is 44 mm Hg).
6. What is a C&S test, and why is it important?
 The term C&S means “culture and sensitivity.” A culture is a growth of an organism on a nutrient media to specifically identify the microbe. After the microbe is isolated, its susceptibility to specific antibiotics, or its sensitivity of the microbe to drugs, is determined. If required, broad-spectrum antibiotic therapy is prescribed until the C&S results are available and a more suitable antibiotic can be identified and prescribed.
7. Why were blood cultures ordered to be drawn?
 According to one theory, bacteria are being shed into the bloodstream when the patient spikes a temperature. Blood cultures should be drawn STAT and before any antipyretic agent or antibiotic is given to try to identify the infecting organism. Blood cultures are positive for a pathogen 7% to 16% of the time.

8. Why are blood cultures drawn from two different sites?

Blood is drawn from two different sites to increase the likelihood of culturing the offending organism. If the patient has an arterial or central venous catheter, one set of cultures might be withdrawn from the catheter after a 10-mL discard sample is withdrawn. Invasive catheters should always be suspected as a source of infection.

9. What would you expect the CXR results to reveal?

- In a patient with pneumonia, you would expect the CXR to reveal patchy areas of consolidation in the area that is affected.
- Other findings from the CXR would include size and fluid accumulation (in lungs, pleural space, or around heart), congestion in large blood vessels of the chest, and the placement of tubes and catheters.

10. The pharmacy sends the ceftriaxone (Rocephin) IV 1 g in 100 mL 0.9% NaCl with instructions to infuse over 40 minutes. At how many milliliters per hour will you regulate the IV infusion pump?

Answer: 150 mL/hr

$$100\text{mL}/40\text{minutes} : x/60\text{minutes}$$

$$x = 150\text{mL}$$

11. Which of the following assessment findings would best indicate that C.K. is responding to therapy?

- Complaints of dyspnea; respiratory rate of 26 on 2 L oxygen; clear lung sounds
- Cough productive of white sputum; temperature of 100.0° F (37.8° C); Sao_2 98% on 2 L NC
- Coarse crackles in posterior lower lobes; respiratory rate 22; no complaints of chills
- Cough productive of yellow sputum; lung sounds clear; Sao_2 96% on room air

Answer: D

If C.K. is responding to therapy, it would be expected that an improvement in symptoms would be seen. Therefore, you would not expect continued complaints of dyspnea, coarse crackles in the posterior lower lobes, or a continued fever. A Sao_2 96% on room air is satisfactory. While clearing of sputum is preferable, a cough productive of yellow sputum could be expected for several weeks following an episode of CAP.

CASE STUDY PROGRESS

C.K. recovers from his pneumonia and is preparing for discharge. You know that C.K. is at increased risk for contracting CAP infections.

12. Discuss four strategies for prevention.

- Teach the importance of immunization with pneumococcal vaccine with a booster in 6 years for patients older than 60 years of age.
- Teach the importance of yearly influenza vaccine. Each year, the CDC predicts which three strains of influenza virus will infect the United States. The vaccine is an inactivated antigen for all three strains.
- Teach the importance of avoiding exposure to people with colds or flu.
- Teach good handwashing technique.
- Teach C.K. how to handle and properly dispose of secretions.
- Teach the importance of PO fluids to thin pulmonary secretions and facilitate expectoration.

13. C.K. confides in you, “You know, my wife died a year ago, and I live alone now. I’ve been thinking ... this pneumonia stuff has been a little scary.” How will you respond?

- Tell him you appreciate his sharing this with you.
- Explore whether he wants to talk more about it.

PART 1 MEDICAL-SURGICAL CASES

- Inquire about his social support system. Does he have family or friends who can look in on him?
- Recognize that he might be experiencing such psychosocial responses as grief, fear of death, and loneliness. Ask about a psychiatric nurse specialist or social services consultation if you consider it necessary.
- How does he get his meals? How does he do his shopping and his laundry? Does he need a social services or a medical nutritional therapy consult? How about a referral to Meals-on-Wheels?
- Make certain his concern is addressed in at least one concrete arrangement before he leaves the hospital.



Case Study 24 Pleural Effusion and Restrictive Lung Disease

Difficulty: Intermediate

Setting: Hospital

Index Words: pleural effusion, restrictive lung disease, pneumonitis, chest tube drainage systems, thoracentesis

► Scenario

A.B., a 40-year-old man, is admitted to your medical floor with a diagnosis of pleural effusion. He complains of shortness of breath; pain in his chest; weakness; and a dry, irritating cough. His vital signs (VS) are 142/82, 118, respirations are 38 and labored and shallow, 102.1° F (38.9° C). His chest x-ray shows a large pleural effusion and pulmonary infiltrates in the right lower lobe consistent with pneumonitis.

- Given his diagnosis, are A.B.'s admission VS expected? Explain.
Yes. Because of pain, infection, possible anxiety, and other factors, A.B. has an increased metabolic rate; his body has to work harder to deliver O₂ and nutrients to the cells. Because of this, A.B.'s SBP is slightly elevated, and he is tachycardic and tachypneic with shallow, labored breathing. His temperature is elevated because of an inflammatory response (pulmonary infection) and increased work of breathing. Hypoxemia will cause anxiety, increased heart rate, and SOB.
- What is pleural effusion?
Pleural effusion is an accumulation of either transudative (serous) or exudative (purulent material) fluid within the pleural space (between visceral and parietal pleura).
- What is the difference between transudate and exudate?
 - Transudate is a watery fluid that diffuses out of the capillaries as a result of disorders that increase BP or decrease capillary oncotic pressure.**
 - Exudate is a fluid with a high content of protein and cellular debris (pus) that has escaped from blood vessels and/or lymphatic vessels and has been deposited in tissues or on tissue surfaces, usually as a result of inflammation.**
- List three common causes of pleural effusion.

Transudative

 - HF**
 - Pulmonary edema or inflammation**
 - Hypoproteinemia**
 - Hemothorax—trauma, surgery, or malignancy**

Exudative

 - Pulmonary infections—pneumonia**
 - Cancer—tumors**
- Review the pathophysiology and consequences of pleural effusion and pulmonary infiltrates.
 - The inflammation of the pleura alters capillary membrane permeability and impairs lymphatic drainage, resulting in excess pleural fluid. As the amount of exudate increases, it compresses lung tissue and reduces lung volumes. Ventilation to the affected area is decreased, but perfusion usually remains unchanged, resulting in a \dot{V}/\dot{Q} mismatch and hypoxemia. A.B.'s effusion freely moves to dependent areas of the lung; the fluid moves to the lower lobes when he is in the upright position and to the posterior lung fields when he is supine.**

PART 1 MEDICAL-SURGICAL CASES

- Pulmonary infiltrate is the accumulation of fluid in the pulmonary tissues (parenchyma). The tissues become heavy and less elastic, thereby making it more difficult to move air in and out of the lungs and slowing diffusion of gases across the alveolar-capillary membrane. Also, accumulation of fluid in the pleural space reduces tidal volume, and hypoxemia continues.
6. How does the underlying pathophysiology give rise to A.B.'s presenting signs and symptoms?
 - Shallow, labored breathing is due to pulmonary infiltrates and fluid accumulation in the pleural space.
 - Weakness is due to hypoxemia related to fluid accumulation in the parenchyma (pulmonary infiltrates).
 - Pain in his chest is due to pleural irritation (pleuritic pain); the pleura are full of pain sensors.
 - A dry, irritating cough is most likely a result of pleural inflammation.
 7. How do you differentiate between cardiac and pleural pain?

A detailed description of chest pain helps distinguish whether pain is pleural or cardiac in origin. Ask the patient whether the pain is continuous or made worse by coughing, deep breathing, or swallowing. Cardiac pain is usually intense and “crushing.” It may also radiate to the arm, shoulder, or neck. Cardiac pain may worsen with exercise. Pulmonary pain varies depending on the cause. Pain that feels like something or “rubbing” inside is more common with pulmonary pain. It commonly occurs on only one side of the chest, usually in the lower lateral portions of the chest wall. The pain might appear only on deep inhalation or be present at the end of inhalation and at the end of exhalation. Pleural pain might be aggravated by position changes or deep breathing. Referred shoulder pain might be either a cardiac or pleural condition.
 8. How does A.B.'s increased metabolic rate affect his nutritional needs?

He will need increased caloric intake to cover the additional work required by his body to deliver O₂ and nutrients to the cells.

CASE STUDY PROGRESS

The physician performs a thoracentesis and drains 1500 mL of fluid. A specimen for culture and sensitivity (C&S) is sent to the laboratory, and A.B. is started on cefuroxime (Ceftin) 1 g IV piggyback q8h.

9. What is a thoracentesis?

It is the removal of fluid from the pleural space using a needle or thin catheter. The fluid is sent for pathologic examination: C&S, cell count, glucose, and total protein. The thoracentesis can be repeated several times if fluid continues to accumulate in the pleural space.
10. The order for the cefuroxime (Ceftin) reads to infuse 1 g in 100 mL 0.9% NaCl over 30 minutes. You have IV tubing that supplies 20 gtt/mL. At how many gtt per minute will you regulate the infusion?

50 gtt/min (20 gtt × 100 mL/30 min)
11. What maneuvers would promote the clearance of pulmonary secretions?
 - Coughing and deep breathing facilitate expectoration of secretions, promote lung expansion, and prevent atelectasis.
 - Use of an incentive spirometry promotes lung expansion and provides a visual feedback for A.B. For example, is he taking in enough air to expand his lungs? Incentive spirometry also provides an objective indicator to determine whether and when expected outcomes are achieved (appropriate volume for A.B.).
 - Nasal, oral, and pulmonary suctioning removes secretions.

12. The pleural C&S results indicate a large amount of *Klebsiella* organism growth that is not sensitive to cefuroxime (Ceftin). What action will you take next?
Because the organism is not sensitive to the antibiotic, you would place the antibiotic on hold and notify A.B.'s physician of the C&S results.
13. Because fluid continues to collect in the pleural space, the physician decides to insert a pleural chest tube under nonemergent conditions. What is your responsibility as A.B.'s nurse?
- Provide adequate analgesia.
 - Obtain a thoracotomy tray, various sizes of chest tubes (28 F and 32 F), sterile gowns, and extra packages of sterile gloves and towels.
 - Set up the chest drainage system, and adjust the suction pressure.
 - Ensure that sterile technique is maintained throughout the procedure.
 - Make certain the tubing connections are airtight and secured with adhesive tape or bands.
 - Make certain petroleum gauze is placed around the chest tube insertion site to create a complete seal.
 - Position the drainage system below the patient's chest.
 - Change A.B.'s position frequently.
14. Evaluate each of the following statements about chest tube drainage systems. Enter “T” for true or “F” for false. Discuss why the false statements are incorrect.
- ___ 1. It is the height of the column of water in the suction control mechanism, not the setting of the suction source, that actually limits the amount of suction transmitted to the pleural cavity.
 - ___ 2. A suction pressure of +20 cm H₂O is commonly recommended for adults.
 - ___ 3. Bubbling in the water-seal chamber usually means that air is leaking from the lungs, the tubing, or the insertion site.
 - ___ 4. The rise and fall of the water level with the patient's respirations reflect normal pressure changes in the pleural cavity with respirations.
 - ___ 5. The chamber is a closed system; therefore, water cannot evaporate.
 - ___ 6. To declot the drainage tubing, put lotion on your hands, compress the tubing, and vigorously strip long segments of the tubing before releasing.
 - ___ 7. You lower the bed on top of the drainage system and break it. You immediately clamp the chest tube, leaving it clamped until you can reestablish the drainage system.
 - ___ 8. The chest tube becomes disconnected from the drainage system. Because you noted an air leak from the lung during your initial assessment, you can submerge the chest tube 1 to 2 inches below the surface of a 250 mL bottle of sterile saline or water.
 - ___ 9. The collection chamber is full, so you need to connect a new drainage system to the chest tube. It is appropriate to momentarily clamp the chest tube while you disconnect the old system and reconnect the new.
 - ___ 10. The drainage system falls over, spilling the chest drainage into the other drainage columns. The total amount of drainage can be obtained by adding the amount of drainage in each of the columns.
- Answers: 1.T; 2. F; 3. T; 4. T; 5. F; 6. F; 7. F; 8. T; 9. T; 10. T**
- Corrections to false statements:**
2. Suction pressure is negative; -20 cm H₂O is common.
 5. The chest drainage system is not a closed system, and H₂O evaporates over time. Observe the H₂O level and add sterile H₂O or NaCl using a sterile catheter tip syringe as needed.

PART 1 MEDICAL-SURGICAL CASES

6. This procedure, called chest tube stripping, is dangerous and should be avoided. Chest tube stripping can cause tissue biopsy (pieces of tissue are sucked through the holes of the chest tube); this procedure can generate up to 400 cm H₂O pressure!
 7. Clamping the chest tube in the presence of an air leak can result in a tension pneumothorax. If you disconnect the tubing without clamping the tubing, the lungs can pull air into the chest cavity; therefore, you need to clamp briefly to exchange the broken chamber for a new one.
- 15.** How will you appropriately maintain A.B.'s chest tube system?
- Frequently auscultate A.B.'s lungs.
 - Assess placement and site of chest tube frequently.
 - Observe and record amount, rate, and type of drainage.
 - Observe water seal fluid level.
 - Observe water seal fluctuations.
 - Evaluate any air leaks in system (bubbles in water seal).
 - Observe for fluid level and bubbling in suction control chamber.

CASE STUDY PROGRESS

After 7 days of aggressive antibiotic and pulmonary therapy, the chest tube is discontinued and A.B. is ready to be discharged.

- 16.** What type of discharge instructions do you need to give to A.B.?
- Because A.B. had a chest tube, he will need to keep a dressing over the site until instructed by the physician that the site is healed to prevent a pneumothorax. He will also need to notify the physician of signs of infection at the site, including fever or increasing redness, swelling, or drainage from the insertion site.
 - He will need to know the dates of his follow-up home care and clinic visit appointments.
 - Stress the importance of taking any medications that he will be taking at home as prescribed.
 - Instruct A.B. to maintain an adequate fluid intake and continue performing coughing and deep breathing efforts and using an incentive spirometer. He will need to get adequate rest until the cough, shortness of breath, and chest pain go away. He may use warm compresses or a moist heating pad to relieve any chest discomfort associated with coughing.
 - Instruct him to call the physician if he has a recurrence of symptoms, particularly fever and chills, increased shortness of breath, onset of nausea and vomiting, and a worsening of chest pain or cough.
 - Because coughing helps clear the airways of mucus and relieves the chest, instruct A.B. not to use cough medicine unless the physician has prescribed it.



Case Study 25 Spontaneous Pneumothorax

Difficulty: Intermediate

Setting: Hospital emergency department, hospital

Index Words: pneumothorax, arterial blood gases (ABGs), emphysema, assessment, respiratory distress, patient education, pleurodesis, chest drainage system

► Scenario

A.W., a 52-year-old woman disabled from severe emphysema, was walking at a mall when she suddenly grabbed her right side and gasped, "Oh, something just popped." A.W. whispered to her walking companion, "I can't get any air." Her companion yelled for someone to call 911 and helped her to the nearest bench. By the time the rescue unit arrived, A.W. was stuporous and in severe respiratory distress. She was intubated, an IV of lactated Ringer's (LR) to KVO (keep vein open) was started, and she was transported to the nearest emergency department (ED).

On arrival at the ED, the physician auscultates muffled heart tones, no breath sounds on the right, and faint sounds on the left. A.W. is stuporous, tachycardic, and cyanotic. The paramedics inform the physician that it was difficult to ventilate A.W. A portable chest x-ray (CXR) shows an 80% pneumothorax on the right.

■ Chart View

Arterial Blood Gases (100% O₂)

pH	7.25
Paco ₂	92 mm Hg
Pao ₂	32 mm Hg
HCO ₃	27 mmol/L
Sao ₂	53%

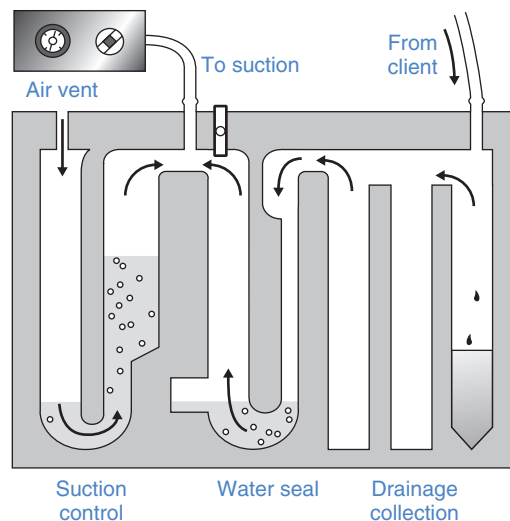
- Given the diagnosis of pneumothorax, explain why the paramedics had difficulty ventilating A.W.
Air escaped from the right lung into the pleural space. Eventually, enough air collected in the pleural space to cause the mediastinum to shift toward the left. The collapsed right lung increased intrapleural pressure, and the leftward shift placed pressure on the left lung, making it difficult to ventilate A.W.
- Interpret A.W.'s arterial blood gases (ABGs).
Significant respiratory acidosis with profound hypoxemia. Without immediate resuscitation, A.W. is near death.
- What is the reason for A.W.'s ABG results?
Eighty percent of her right lung is collapsed and is not taking part in gas exchange. Her left lung, great vessels, and heart are compressed also.
- The physician needs to insert a chest tube. What are your responsibilities as A.W.'s nurse?
 - Prepare for immediate needle aspiration (the physician will use a 14- or 16-gauge spinal or cardiac needle).
 - Set up a chest tube drainage system, obtain size 28F and 32F chest tubes, and prepare a thoracotomy tray for a thoracostomy (chest tube insertion).

PART 1 MEDICAL-SURGICAL CASES

- Monitor chest drainage.
 - Frequently assess for breath sounds.
 - Although A.W. is stuporous, you do not know what she can hear or process. Briefly tell her that her lung collapsed and that the physician is going to put a tube in her chest to get rid of the air and help her breathe. Be constantly aware of patient emotional support needs throughout the procedure.
- As the nurse, it is your responsibility to ensure pain control. In A.W.'s case, would you administer pain medication before the chest tube insertion?
 - No. This is an emergency; you cannot take the time to obtain and administer pain medication. The physician will inject lidocaine at the insertion site.
 - In addition, pain medication might interfere with a neurologic examination and suppress BP and respiratory effort.
 - The ED physician inserts a size 32F chest tube in the sixth intercostal space, midaxillary line. Would you expect to observe an air leak when A.W.'s chest drainage system is in place and functioning?

Yes. If A.W. ruptured a bleb into her pleural space, inspired air would continue to escape into the pleural space and into the chest tube drainage system until the hole healed.
 - Would you expect A.W.'s lung to reexpand immediately after the chest tube insertion and initiation of underwater suction? Explain.

Not necessarily. It can take hours to days for the lungs to completely inflate.
 - Part of your responsibilities after the chest tube is inserted is to assess for fluctuation in the water-seal chamber and bubbling in the suction-control chamber. Label the areas on the chest drainage system that you would be monitoring.



9. What do you need to document regarding A.W.'s chest drainage system?

Most institutions have the nurse document the character, color, and amount of pleural drainage every 8 hours and as needed. The nurse also needs to note the presence/absence of an air leak every 8 hours; as well as the amount of suction being delivered. You will mark the level of drainage on chest drainage system columns a minimum of every 8 hours and record amount of output. Related assessment findings that need to be documented include A.W.'s lung sounds, respiratory pattern, pulse oximetry, vital signs, and pain level.

10. What instructions do you need to give to the nursing assistive personnel (NAP) who is working with A.W.?

The NAP must keep the drainage system below A.W.'s chest at all times. The patient may ambulate with the chest tube; the drainage system should be kept on the side of insertion. The chest tube tubing should be kept as straight as possible, avoiding kinks and dependent loops. If already taught, the NAP can encourage A.W. to cough, deep-breathe, and use the incentive spirometer.

11. The clerk tells you A.W.'s husband has just arrived; A.W. will be admitted to the hospital. How would you address this issue with her husband?

- Look for him in the ED waiting area, and tell him that A.W. is responding well to treatment. Inform him that one of her lungs collapsed, so the physician put a tube in her chest to let the air out and allow the lung to expand again. Tell him that the tube will stay in her chest until the lung stays inflated on its own. That means she will have to be admitted to the hospital so that her condition can be monitored.
- Accompany him into A.W.'s room, and remain alert to help him into a chair or onto the floor if he experiences vertigo or a syncopal episode.
- Explain the tubes and monitoring equipment in very simple terms—for example, “This machine allows us to watch her heart. This one measures her blood pressure. This is the tube that lets the air out of her chest so that she can breathe better.”
- Provide tissues, and tell him where the restrooms are located.
- Ask him whether he needs to use the telephone (someone might need to bring clothing, provide transportation, or stay with him to offer support).
- Ask him whether he needs anything (juice, water) to make him more comfortable.

12. You approach A.W.'s bedside and ask about what looks like two healed chest tube sites on her right chest. A.W.'s husband informs you that this is the third time she has had a collapsed lung. He asks whether this trend will continue. How will you respond?

If A.W. continues to experience spontaneous pneumothoraces in the same area of the lung, the physician might elect to “scar” the surface of the lung in that particular area. The medication is irritating, and scar tissue forms on the outside of the lung. It is more difficult for the thick scar tissue to rupture than the thinner lung tissue. The treatment is effective, but it is also painful for the patient.

CASE STUDY PROGRESS

Because A.W. has a history of spontaneous pneumothoraces on the right side, the physician elects to perform chemical pleurodesis.

13. A.W. asks what a pleurodesis is. How would you describe this procedure and what will happen?

Pleurodesis is the instillation of a liquid sclerosing substance, such as doxycycline, talc, or bleomycin, into the pleural space via a chest tube to create an inflammatory response that causes the pleura to adhere and sclerose to each other. Because the spreading of the medication can be associated with a significant amount of burning, the patient should receive adequate intravenous pain medication and sedation before and during the procedure. During the instillation, the patient is rolled side to side to spread the substance throughout the pleural space. Afterward, A.W. will be placed on a rotation schedule to assist with the distribution of the medication. Vital signs will be monitored every 4 hours for 24 hours.

PART 1 MEDICAL-SURGICAL CASES

CASE STUDY PROGRESS

A.W. recovers and is discharged to her home 4 days later with a chest tube and Heimlich valve. The physician connects the one-way (Heimlich) valve between the distal end of the chest tube and a drainage pouch.

14. Discuss the purpose of this device.

During inspiration, negative intrapleural pressure closes the valve and prevents air from entering the pleural space. During expiration, positive pressure opens the valve and allows air and/or fluid to drain into a plastic pouch. This valve makes it possible to discharge patients who have a residual air leak. The chest tube is removed after the air leak heals.

15. You teach A.W. and her husband about the care of the chest tube and Heimlich valve. Which of these statements would indicate that further teaching is necessary? (Select all that apply.)
- “I will maintain an occlusive dressing around the chest tube site.”
 - “I can shower if the device is completely covered in plastic.”
 - “When moving around, the collection system must be kept below the insertion site.”
 - “I will notify the physician if there is a change in the color or amount of drainage.”
 - “The arrow on the flutter valve should always point toward me.”
 - “I will check the insertion site twice daily for swelling, redness, and drainage.”

Answers: B, E

When a patient is discharged with a flutter valve and chest tube, the patient must be taught how to maintain patency of the system. The insertion site must be kept dry and clean. An occlusive dressing must be kept around the site. He or she needs to avoid swimming and bathing because the valve must not be submerged in water. To safely ambulate with a mobile chest tube drainage system, the collection system must be kept below the level of the insertion site and all connection must be secure. The patient and caregiver need to know when to contact the health care provider. Reasons for notifying the health care provider include changes in the drainage system, such as a change in color or amount of drainage and leakage on the dressing around the chest tube, as well as symptoms of fever, chest pain, and dyspnea. The insertion site should be checked twice daily for signs of infection: fever or increasing redness, swelling, or drainage from the insertion site; the physician should be notified if any of these are present. Because there is a mechanical one-way valve instead of a water-seal chamber, the arrow indicator on the one-way flutter valve housing must always point away from the patient. Otherwise, there is a risk for air trapping and a recurrent pneumothorax.

Case Study 26 Mechanically Ventilated Patient

Difficulty: Intermediate

Setting: Intensive care unit

Index Words: mechanical ventilation, endotracheal tube (ETT), assessment, acute respiratory failure (ARF), arterial blood gas (ABG)

► Scenario

P.R., a 61-year-old woman who has no history of respiratory disease, is being admitted to your unit with a diagnosis of pneumonia and acute respiratory failure. She was endotracheally intubated orally in the emergency room and placed on mechanical ventilation. Her vital signs are 112/68, 134, 101° F (38.3° C) with an SaO_2 of 53%. Her ventilator settings are synchronized intermittent mandatory ventilation of 12 breaths/min (BPM), tidal volume (V_T) 700 mL, FiO_2 0.50, positive end-expiratory pressure (PEEP) 5 cm H_2O .

1. Describe the pathophysiology of acute respiratory failure (ARF).

ARF is the inability of the body to sustain respiratory drive resulting in a decreased capacity to exchange oxygen and CO_2 . Acute respiratory failure can be a result of either the failure to oxygenate, the failure to ventilate, or a combination of both. Type I, or hypoxemic ARF, is defined as the inability to maintain a Pao_2 greater than 60 mm Hg with the client at rest and breathing room air. This type of ARF is associated with pulmonary edema, pulmonary emboli, atelectasis, pneumonia, emphysema, acute respiratory distress syndrome, and loss of functional lung tissue, such as following various lung removal surgeries. Type II ARF, or the failure to ventilate, results from disease processes that interfere with a client's ability to effectively remove CO_2 . Type II ARF is characterized by a $Paco_2$ greater than 60 mm Hg or a pH less than 7.35. It is associated with COPD, restrictive pulmonary diseases (obesity, pneumothorax, and diaphragmatic paralysis), neuromuscular defects (Guillain-Barré syndrome, myasthenia gravis, multiple sclerosis, intentional overdose, and spinal cord injury), central nervous system dysfunction (stroke, meningitis, and ICP), and chest trauma.

2. What assessment findings would you expect P.R. to exhibit?

- Altered level of consciousness, with P.R. being confused and difficult to arouse
- Electrolyte abnormalities, caused by a falling pH level, might cause cardiac dysrhythmias
- Headache related to hypercapnia
- Pulsus paradoxus or a drop in systolic blood pressure more than 10 mm Hg during inspiration
- Diaphoresis and fever related to infection
- Tachycardia and hypotension related to vasodilation and hypoxia

■ Chart View

Arterial Blood Gases

pH	7.28
$Paco_2$	62 mm Hg
HCO_3	26 mmol/L
Pao_2	48 mm Hg
SaO_2	53%

PART 1 MEDICAL-SURGICAL CASES

3. The arterial blood gas (ABG) results drawn in the emergency room before intubation are sent to you. Interpret P.R.'s ABG results.
P.R.'s pH indicates that she is acidotic. Her Paco_2 level is high which indicates that she is retaining carbon dioxide, which is consistent with acute respiratory failure. Her bicarbonate level is within normal limits. A Pao_2 of 55 mm Hg indicates hypoxemia related to respiratory failure. These are consistent with respiratory failure, which is described as a Pao_2 of 60 mm Hg or lower and a Paco_2 of 50 mm Hg or higher in a client with no history of respiratory disease.
4. List eight interventions that would be implemented for P.R. and the rationale for each.
- Sputum culture and sensitivity followed by IV antibiotics to combat the pneumonia
 - Inhalation therapy with bronchodilators and corticosteroids to relax bronchial smooth muscles, open airways and reduce inflammation, improving P.R.'s ability to oxygenate
 - Hemodynamic monitoring
 - Arterial line will allow for continuous blood pressure monitoring and allow for ready access to an arterial blood gas sample
 - Nasogastric tube to low intermittent suction to drain stomach contents, lowering risk of aspiration
 - Foley catheter to drain to assist in closely monitoring P.R.'s fluid status
 - DVT prophylaxis with heparin or a similar anticoagulant
 - IV fluids will be given to maintain fluid volume and prevent dehydration
 - Frequent monitoring of electrolytes with replacement therapy as needed; this will assist in preventing cardiac dysrhythmias
 - Prophylactic therapy with histamine-2-antagonists, cytoprotective agents, or gastric proton pump inhibitors to reduce the risk of GI bleeding.
5. After the insertion of the endotracheal tube (ETT), how is correct placement verified?
Multiple methods are used to check placement because none is 100%. A CXR can be used to confirm placement of an ETT. Other methods include listening for equal bilateral breath sounds on each side of the chest as well as observing equal bilateral chest expansion. No breath sounds should be heard over the stomach, and a small amount of condensation will be seen in the lumen with each breath. Common measuring instruments include capnography, calorimetric end-tidal CO_2 detector, an esophageal detection device, or a self-inflating esophageal bulb.
6. Describe each of P.R.'s ventilator settings and the rationale for the selection of each.
The selection of ventilatory settings depends on the patient's underlying condition, severity of respiratory failure, and body size.
- V_T is the volume of inspiratory flow delivered. Average V_T is 6 to 8 mL/kg ideal body weight in adults. The minimal amount should be used to minimize the risk of barotrauma.
 - With the use of synchronized intermittent mandatory ventilation, the ventilator delivers a set number of breaths per minute at the specified tidal volume. In between these breaths, the patient can spontaneously breathe at his or her own rate and tidal volume. Because P.R. is not unconscious and can initiate spontaneous breaths, this setting is more comfortable than continuous mandatory ventilation and reduces the risk of hyperventilation that would be associated with assist-control (A/C) mode.
 - PEEP is positive airway pressure applied during expiration to keep the alveoli open and reduce the amount of shunting. The goal of using PEEP is that the Fio_2 may be reduced to the lowest possible level to maintain gas exchange and to prevent oxygen toxicity.
 - Fio_2 or fraction of inspired oxygen is the concentration of oxygen being delivered to the patient.
 - BPM or rate is the number of ventilations delivered each minute. The initial rate with synchronized intermittent mandatory ventilation is usually set at 10 to 14 breaths per minute.

■ Chart View

Arterial Blood Gases

pH	7.30
Paco ₂	52 mm Hg
HCO ₃	22 mmol/L
Pao ₂	70 mm Hg
Sao ₂	88%

7. ABGs are redrawn after P.R. is on mechanical ventilation for 1 hour. What ventilator changes do you anticipate, based on your interpretation of these values? (Select all that apply, and explain your rationale.)
- Increasing the PEEP to 10 cm
 - Increasing the rate on the ventilator to 16 breaths/min
 - Increasing the tidal volume to 850 mL
 - Changing to continuous mandatory ventilation

Answers: A, B

P.R.'s pH and Paco₂ indicate that she is retaining carbon dioxide; therefore, you would anticipate raising the respiratory rate so that the lungs can blow off carbon dioxide. In ARF, an increase in the positive pressure would be useful in opening collapsed alveoli and facilitating gas exchange, which should raise the Pao₂ levels.

Raising tidal volume will increase the chance for complications such as pneumothorax. The continuous mandatory ventilation mode is used for clients with no control of respirations, such as those who are unconscious or paralyzed; therefore, it is not appropriate for P.R.

8. Evaluate each of the following statements about caring for P.R. or a similar patient receiving mechanical ventilation with an ETT. Enter “T” for true or “F” for false. Discuss why the false statements are incorrect.
1. Administer mandatory muscle-paralyzing agents to keep the patient from “fighting the vent.”
 2. Check ventilator settings at the beginning of each shift and then hourly.
 3. When suctioning the ETT, each pass should not exceed 15 seconds.
 4. Assign an experienced NAP to take vital signs every 2 to 4 hours.
 5. Perform a respiratory assessment once per shift.
 6. Empty excess water as it collects in the ventilation tubing back into the humidifier.
 7. Keep a resuscitation bag at the bedside.
 8. Monitor the cuff pressure of the ETT every 8 hours.
 9. Keep ventilator alarms silenced when in the room to maintain a quiet environment.
 10. Change the ventilator tubing every 12 hours.

Answers: 1. F; 2. T; 3. T; 4. T; 5. F; 6. F; 7. T; 8. T; 9. F; 10. F

Corrections to False Statements:

- Not all patients receive therapy with muscle-paralyzing agents while mechanically ventilated. In some instances, this therapy is used to keep the patient from “fighting the vent.” They might also be administered to maintain better ventilation, to lower metabolic demands, and to assist in maintaining higher levels of PEEP.
- Patients requiring mechanical ventilation need to be assessed more frequently than once per shift. Lung sounds and other respiratory assessments should be performed every 1 to 2 hours.

PART 1 MEDICAL-SURGICAL CASES

6. The excess water that collects should be emptied, not poured back into the system.
 9. All ventilator alarms should be kept on at all times to alert the nurse to changes in the client's condition.
 10. Current recommendations from the CDC are that ventilator tubings be changed every 48 hours or as needed; however, many practice settings routinely change tubings every 24 hours, although current research does not support this practice.
9. You hear the high pressure alarm sounding on the mechanical ventilator and see that P.R.'s SaO_2 is 80%. What are the potential causes of this problem?
The high-pressure alarm can be triggered when there is increased airway resistance. Increased airway resistance might be caused by secretions, bronchospasms, ETT dislodgement, biting, coughing, kinked ventilatory circuit tubing, or the patient "fighting the ventilator."

CASE STUDY PROGRESS

As P.R.'s nurse, you are concerned about meeting her needs for fluids, nutrition, oral hygiene, and skin integrity.

10. Discuss five indicators that would help you assess fluid status.
 - VS
 - Lung sounds
 - Consistency of sputum
 - Skin turgor
 - 24-hour I&O trends
 - Urine-specific gravity
 - Presence or absence of edema
 - Body weight over time
 - Visible moistness of mucous membranes and eyes
 - Dehydration causing higher lab values as a result of hemoconcentration
11. What are your nutritional goals for P.R.?
She will exhibit adequate nutritional intake, as evidenced by stable weight, adequate intake of calories, absence of infection, laboratory values within normal limits (serum albumin, prealbumin, total protein, ferritin, transferrin, hemoglobin, hematocrit, and electrolyte levels), and adequate muscle strength to breathe spontaneously.
12. Describe interventions that you could use to assist in meeting P.R.'s nutrition goals.
 - Provide adequate nutrition (high-calorie intake, protein, vitamins, and minerals) by a tube feeding by the third day of mechanical ventilation.
 - Obtain a nutrition consult as needed.
 - Weigh the client daily.
 - Monitor I&O.
 - If P.R. cannot tolerate enteral feeding, consider total parenteral nutrition (TPN).
 - Assess bowel function every 2 to 4 hours.
13. The goal related to P.R.'s mouth care is to preserve the oral mucosa and dentition. Identify three strategies for providing oral hygiene with an ETT in place.
 - Use artificial saliva (normal pH for mouth) tid and prn to decrease the risk for an oral infection.

- Perform mouth care every 2 to 4 hours while patient is awake and every 6 hours at night. Use a soft pediatric-size toothbrush to prevent tissue damage. Use half-strength H₂O₂ and follow by NS rinse if patient is unable to brush the teeth.
 - Use nystatin swish and swallow prophylactically with antibiotic therapy to decrease the risk for developing a *Candida* infection in the mouth; put it in with sponge or syringe, and suction nystatin if the patient cannot swallow.
 - Reposition the ETT every 24 hours.
- 14.** What is the rationale for not taking an oral temperature near an ETT?
- The air passing through the ETT is warmed and humidified. The heat is conducted to the anatomic structures around the ETT and results in a falsely elevated temperature reading.
 - The mouth cannot close with an oral tube, so it is difficult to get an accurate temperature.
- 15.** You assess P.R.'s skin every 4 hours. Identify three treatment goals in relation to skin and positioning.
- Relieve pressure on the skin.
 - Improve pulmonary ventilation.
 - Enhance comfort.
 - Prevent contractures such as footdrop.
- 16.** What four strategies will facilitate the expected outcome of maintaining skin integrity?
- Use therapeutic positioning for the return of functioning (e.g., a pad under the shoulder to effect normal body position).
 - Turn or reposition the patient at least every 2 hours.
 - Offload elbows and heels to prevent skin breakdown.
 - Use moon boots or high-top shoes to prevent footdrop.
 - Evaluate the appropriateness of overlay air mattress or replacement of the regular mattress with an air mattress.
- 17.** That afternoon, a powerful storm causes a power failure. What do you do?
- Get the resuscitation bag, connect it to the portable O₂ tank, and manually ventilate P.R.
 - Reassure her that she is going to be OK and that someone will stay with her until the power is restored.
 - Keep a flashlight with P.R. so she will not be afraid.



Case Study 27 Mechanically Ventilated Patient

Difficulty: Advanced

Setting: Extended care facility

Index Words: Guillain-Barré syndrome (GBS), sedation, tracheostomy care, medications, mechanical ventilation, symptom management, crisis management

► Scenario

P.W., a 33-year-old woman diagnosed with Guillain-Barré syndrome (GBS), is being cared for on a special ventilator unit of an extended care facility because she requires 24-hour-a-day nursing coverage. She has been intubated and mechanically ventilated for 3 weeks and has shown no signs of improvement in respiratory muscle strength. Her ventilator settings are assist-control (A/C) of 12 breaths/min, tidal volume (V_T) 700 mL, F_{iO_2} 0.50, and positive end-expiratory pressure (PEEP) 5 cm H_2O . Her vital signs are 108/64, 118, 12, 100.6° F (38.1° C). She is receiving enteral nutrition by PEG (percutaneous endoscopic gastrostomy [with a transjejunal limb]) tube (2800 kcal/24 hr).

- Why is P.W.'s ventilator mode on A/C?
 - P.W. must not have enough innervation to her respiratory muscles to trigger the ventilator to deliver a breath, so the machine is doing all of the work.
 - If she is alert, the mode might be able to be changed to make her more comfortable.
- P.W. is receiving lorazepam (Ativan) 1 mg slow IV push (IVP) q4h to reduce her anxiety. Identify two factors that should be considered when choosing lorazepam for P.W.
 - Lorazepam is metabolized in the liver. Is her liver functioning properly?
 - What is P.W.'s level of sedation? You want her to remain alert.
- Identify nine nonpharmacologic strategies that you could use to reduce P.W.'s anxiety, increase her comfort, and reduce the need for lorazepam. Be creative!
 - Observe closely for clues to overt and covert needs.
 - Develop a simple form of communication, such as a combination eye blinking and movement system.
 - Encourage communication. Allow P.W. time to communicate and provide feedback.
 - Reassure P.W. that anxiety and other negative feelings are understandable and expected.
 - Use TV and radio for reorientation or diversion.
 - Provide her favorite relaxing music (not *your* favorite!).
 - Use relaxation techniques.
 - Provide backrubs.
 - Have her children tape messages or songs and play the tapes as she requests.
 - Create a special time when her children can visit.
 - Involve the family in her care.
 - Provide private time for P.W. and her husband.
- You note that 2800 kcal/24 hr is a higher than expected caloric requirement for a woman who is 5'4" and 123 pounds. Offer a possible explanation for her caloric needs.

The given scenario tells us that P.W. is on a ventilator and has a fever; thus, she requires a higher daily caloric requirement.

PART 1 MEDICAL-SURGICAL CASES

5. You give P.W. a bath and note that her cheeks billow outward each time the ventilator delivers a breath. What could cause this phenomenon?
 - Air leak in the cuff, inflation tube, or inflation valve of the ETT.
 - The trachea might have become dilated from the constant pressure of the ETT cuff.
 - The lungs might have become increasingly stiff from pulmonary edema. When the ventilator delivers the breath, the stiff lungs resist inflation and force the air to flow around the cuff.
 - If the ETT were pulled out (proximal to the vocal cords), the ventilator alarm would go off.

6. You try repositioning P.W., place a stopcock in the inflation valve, auscultate the lungs, check the length of the tube at the lip (the tube had not moved), check the cuff, and note the air pressure is low. You insert more air in the cuff to seal the leak. Over the next 24 hours, the leak becomes worse, and the ventilator's low exhaled volume alarm repeatedly sounds. What action will you take?

Notify the physician of the air leak. Because the ETT has been in place for 3 weeks, and P.W. shows no signs of increased inspiratory muscle strength, the physician might elect to replace the ETT or, more likely, perform a tracheostomy.

7. The physician elects to insert a no. 8 Shiley tracheostomy (trach) tube with a disposable inner cannula. P.W. becomes increasingly anxious after receiving the news. How would you prepare P.W. and her husband for the tracheostomy?
 - Show them a picture of a tracheostomy tube, and explain that placement requires a brief surgical procedure. The tract, or hole, develops in about 1 week; then the trach tube is changed monthly. Inform them that the trach tube will cause increased mucus production for the first several weeks until P.W.'s body becomes used to the new tube, then secretions will decrease. The incision must be cleaned at least every 4 hours until the secretions subside, then every 8 to 12 hours. As with any incision, you have to use sterile technique and observe for signs of infection.
 - Tell her she won't have a tube in her mouth.
 - Tell her she might be able to get off of the ventilator sooner.
 - Once P.W. is able to breathe on her own, the tube is removed, the stoma is covered with a dressing, and the hole takes about 3 days to heal. P.W. will have a slight scar at the base of her neck where the tube was inserted.

8. P.W. undergoes the tracheostomy procedure without complications. When you return in the morning and assess the new tracheostomy, you note that the trach tape looks tight. You are unable to insert one finger between P.W.'s neck and the trach tape. Discuss whether this is problematic.

Yes, this is problematic. If the trach tape is tied too tightly, the tracheostomy flange completely covers and compresses the stoma. This could result in infection of the incision or the leakage of air into the surrounding subcutaneous tissues.

9. What should be your next actions?
 - Notify the physician. Ask whether he or she wants to come and assess the site or whether you should do trach care and change the trach ties.
 - Ordinarily, the trach tapes are not changed for 48 hours after a tracheostomy; however, it is required, in this case. If the physician doesn't come, then you perform trach care, observe the incision, palpate the surrounding tissues, and tie the trach tapes loosely enough to allow one finger to fit under the tapes.
 - Document the findings.
 - Complete an incident report, and write a note to inform the previous nurse about the incident. Do not chart that you wrote an incident report.

- 10.** You note that the tissue surrounding the incision is edematous. As you palpate the area, your fingers sink into the skin, and you auscultate a popping sound through your stethoscope. What does this mean?

P.W. has subcutaneous emphysema around the incision. It occurs when there is an opening or tear in the trachea and air escapes into fresh tissue planes of the neck.

- 11.** What will be your next actions?

- **Instruct P.W. that a small amount of air has leaked into the tissue around the incision, that you have loosened the trach tape, and that the air will be reabsorbed in a day or so.**
- **Notify the physician.**
- **Document the findings.**
- **Meanwhile, keep P.W.'s HOB elevated to allow the air to escape from the trach incision. Assess the progression by marking the skin with a skin-marking pencil at the outer periphery of emphysematous tissue.**

- 12.** After lunch, you evaluate P.W.'s activity tolerance and note that she desaturates when turned to her right side. You auscultate posteriorly tubular breath sounds in the entire right lung. Based on your knowledge of pathophysiology, explain the probable cause of the desaturation. **Normally, pulmonary tissue carries vibrations from the airways to the anterior chest wall. Because parenchymal tissue is not dense, the vibrations are weak and barely audible with deep inspiration. However, when the parenchyma becomes edematous with large amounts of fluid (as occurs during infection), the pulmonary tissue augments the vibration of inspiratory air waves through the chest wall, which results in the auscultation of tubular breath sounds. In addition, it becomes increasingly difficult for gases to diffuse through the thickened membranes; thus, when O₂ demands increase, as with increased activity, the body is unable to meet the increased demand, and the blood becomes desaturated.**

CASE STUDY PROGRESS

You notify the physician of the change in P.W.'s breath sounds. The paramedic unit transports P.W. to the hospital, where she is readmitted for recurring pneumonia.

- 13.** P.W.'s husband arrives shortly after the paramedics transport P.W. to the hospital. He collapses into the nearest chair, tears begin to roll down his cheeks, and he says, "It has been almost a month now. Are you sure she will recover?" How would you respond?
- **There is no way to predict recovery from GBS. Reinforce that the recovery time varies from person to person, but most people with GBS recover in weeks to months with little to no residual lung impairment; 10% to 20% of people who are diagnosed with GBS are left with some residual disability.**
 - **Validate his feelings of frustration and disappointment. Acknowledge that it has been hard on him and that both he and P.W. have been through a tremendous ordeal. Reassure him that it will end.**
 - **Ask him whether he has anyone to talk to, such as family or a support group.**
 - **Have a social worker contact him to address his needs and fears.**

CASE STUDY PROGRESS

P.W. undergoes aggressive antibiotic therapy and returns to the extended care facility 7 days later. Over the several weeks, she progressively regains neurological functioning.

PART 1 MEDICAL-SURGICAL CASES

- 14.** What factors would be considered in determining whether P.W. is ready to be weaned from mechanical ventilation?

Weaning assessment parameters include a combination of respiratory and nonrespiratory factors. First, there should be a reversal of the cause of the respiratory failure, which, in this case, is the resolution of GBS. P.W. should demonstrate adequate muscle strength and the ability to initiate an inspiratory effort. Her lungs should be reasonably clear on auscultation and chest x-ray. It is important to have an alert, well-rested, and well-informed patient relatively free from pain and anxiety who can cooperate with the weaning plan. P.W. needs to be hemodynamically stable, have fluid and electrolytes balance, and have an acceptable hemoglobin level.

- 15.** What are your responsibilities during the weaning process?

Most patients will be excited about coming off of the ventilator, but, at the same time, concerned about being able to breathe on their own. Explain the weaning plan to P.W. and assure her you will remain at her bedside to monitor her progress. Obtain baseline vital signs and respiratory parameters. During weaning, closely monitor P.W. for signs of intolerance, including tachypnea, dyspnea, tachycardia, dysrhythmias, an SpO₂ less than 91%, hypertension or hypotension, agitation, diaphoresis, anxiety, and changes in the level of consciousness. Document P.W.'s tolerance throughout the weaning process.



Case Study 28 Emphysema

Difficulty: Advanced

Setting: Home care

Index Words: emphysema, smoking, oxygen therapy, sleep disorder, patient education, home care, risk factors, Internet resources, assessment, dyspnea

► Scenario

C.E., a 73-year-old married man and retired railroad engineer, visits his internist, complaining: “Whenever I try to do anything, I get so out of breath I can't go on. I think I'm just getting older, but my wife told me I had to come see you about it.” His resting Sao_2 registers 83%. He is sent to the local hospital for a chest x-ray and arterial blood gases to be drawn after resting 20 minutes on room air. C.E. returns to the office, and after obtaining the results, the physician tells him that he has severe emphysema and must start on continuous oxygen (O_2) therapy at 2 L flow rate.

1. How should C.E.'s chief complaint be recorded?
 “Whenever I try to do anything, I get so out of breath I can't go on.” Remind students of the need for exact words in recording the C/C.
2. What is emphysema?
 Emphysema is a progressive and irreversible disease affecting the small airways. It is characterized by terminal airway thickening, parenchymal destruction, and pulmonary vascular abnormalities that lead to air trapping, premature airway closure, and hypoxemia. The most common presenting symptom is SOB. Together, emphysema and chronic bronchitis comprise what is known as *chronic obstructive lung (pulmonary) disease (COLD or COPD)*.
3. What is the most common cause of emphysema?
 Smoking accounts for 82% of emphysema.
4. Based on this information, what questions will you ask about health behaviors?
 - Ask whether he smokes; also ask what, how much, and how long he has smoked. Was he exposed to second-hand smoke?
 - Ask about lung toxin exposure in the workplace or at home (asbestos from brake lines for mechanics; lead for plumbers; solvents, aerosolized pesticides, and herbicides for farmers). Did he wear personal protective gear?
5. What is the rationale for starting C.E. on oxygen at only 2 L flow rate?
 High-flow oxygen is contraindicated in patients with COPD because the patient depends on the hypercapnic drive to breathe. If too much oxygen is administered, this drive is ineffective and can result in diminished respirations and hypoxia.

CASE STUDY PROGRESS

The physician tells C.E. that his office will have a home health equipment company call him to make arrangements to deliver liquid O_2 equipment and educate him in its use. As a registered nurse (RN) working for the company, you are assigned to make the initial home visit.

PART 1 MEDICAL-SURGICAL CASES

6. What general criteria need to be fulfilled for Medicare to pay for C.E.'s home oxygen therapy?

For Medicare and most insurance companies to cover the cost of continuous oxygen therapy, the patient must have severe hypoxemia, which is defined as a P_{aO_2} level less than 55 mm Hg or an arterial oxygen saturation Sp_{O_2} of less than 88% on room air and at rest. The criteria vary when hypoxemia is caused by cardiac disease or when oxygen is needed at night only.

7. How would you prepare for the first visit?
- Check with Medicare and C.E.'s supplemental insurance company to see what is covered; Medicare has specific contracted arrangements, and these are constantly changing.
 - Call to make an appointment when both C.E. and his wife can be there.
 - Take several business cards, and be certain they have a 24-hour emergency telephone number.
 - Collect patient education materials about emphysema (see previous) and the use of O_2 .
 - Pack the O_2 units, O_2 adaptors, 50 to 100 feet of O_2 tubing, several nasal cannulas (NCs), and a small in-line flow meter.
8. What issues would you address with C.E. and his wife?
- Using simple illustrations and patient education materials, show them what emphysema is.
 - Using simple terms, explain why C.E. needs O_2 .
 - Show them the O_2 equipment, and explain how to use it. Give a demonstration, then have C.E. explain everything to you and demonstrate how to use the equipment. Finally, have his wife review and demonstrate the use of the equipment.
 - Using patient education materials, review how to use O_2 safely (do's and don'ts), how to travel with O_2 , and when to seek medical treatment. Leave these materials with them, and highlight the most important information.
 - Inform them that you will visit again to reinforce the information discussed during this visit (do not overwhelm them, stick to the basics, and give C.E. a successful experience).
 - Repeat instructions concerning the 24-hour emergency services available to them.
 - If C.E. received a demand regulator, walk him with an oximeter to make certain his Sa_{O_2} is over 90%. Most demand valves do not work with a flow rate greater than 2 L/min or for mouth breathers or those with severe disease.
9. The next time you visit, C.E. complains of sores behind his ears. He explains, "That long oxygen tubing seems to take on a life of its own. It twists around and gets caught under doors, chairs, everything. It darn near rips the ears off my head." What can you tell him that could help?
- Cushion the top and posterior side of the ears so the O_2 tubing doesn't rub. Medical supply companies carry a sponge wrap. The sponge is approximately 3 inches long and has a lengthwise slit that fits over the O_2 tubing to protect the ears. The tubing must be taped in place to prevent slipping.
 - Examine the "sores" for signs of infection and advise his wife what to look for, how to keep the area clean, and how to promote healing.
 - Show C.E. how to make a "sag line" in the O_2 tubing by tucking a loose loop of about 2 feet into his belt or pocket to protect his ears from the stress of unplanned "jerks."
 - Explain that COPD increases his nutritional needs for protein to prevent skin breakdown.

10. You auscultate C.E.'s breath sounds and detect the odor of Vicks VapoRub. When you question C.E. about the use of Vicks, he tells you that he started to apply it in and around his nose to prevent his nose from becoming dry and sore. How would you counsel C.E. and his wife regarding safety issues with oxygen use?
- Remind C.E. that it is dangerous to use vapor rubs or petroleum-based products around O₂. There is a false perception that O₂ is very flammable. O₂ itself does not burn; however, it supports combustion, and petroleum melts. All it would take is a spark to start a fire. Once a fire starts, the petroleum might burn his nasal passages.
 - Educate him to use lanolin, a water-based aloe moisturizing gel, K-Y Jelly, or a saline nasal spray to keep his nasal passages moistened.
 - If there are any smokers in the house, provide a checklist that includes no smoking within 10 feet of O₂, keep tanks away from smokers, there must be working smoke detectors, and they must be checked every month, etc.

CASE STUDY PROGRESS

At your next visit 3 weeks later, C.E. tells you that the previous evening he walked to the kitchen for a snack and became increasingly short of breath. As per your instructions, C.E. removed the nasal cannula, tested the flow against his cheek, and felt no O₂ flowing from the catheter. He lacked the force and volume required to yell for help and was too short of breath to return to the living room to check his O₂ tank. He bent forward with his elbows on the countertop and struggled to breathe. He became more frightened with each passing second, and his breathing became increasingly more difficult. A minute later, C.E.'s wife found him and reconnected his O₂ tubing. C.E. sat at the table for 20 minutes before he could walk back to the living room.

11. Why did C.E. assume the peculiar position at the countertop?
- He leaned forward. This position takes advantage of gravity; the bowels are pulled forward, thereby allowing more room for the diaphragm to expand.
 - He placed his elbows on the table. Normally, the inspiratory muscles of the neck are responsible for lifting the first two ribs upward. By placing his elbows on the table, C.E. mechanically lifted the ribcage into a maximally expanded position and spared the inspiratory muscles the workload of accomplishing this task, thereby conserving energy. This position allows maximal pulmonary expansion and minimal energy output to accomplish inspiration.
12. A week later you receive a call from C.E.'s wife. Since the incident, C.E. "doesn't want her out of his sight." She asks you to come to the house and "talk some sense into him." What teaching strategies will you use with C.E. and his wife?
- Acknowledge his feelings of fear and panic at suddenly being without O₂.
 - Explain that fear causes the airways to dilate and makes it more difficult to get enough air in and out. (An epinephrine flush causes the bronchi to dilate, thereby increasing dead space volume.)
 - Practice pursed-lip and abdominal breathing with C.E. He should practice these techniques every day so that when he has another panic attack, he can focus on one breath at a time (getting air in, then getting air out). He can relax himself enough to stop the epinephrine flush and stop the resulting bronchodilation. He can practice these breathing techniques anytime and anywhere.
 - Work out a plan whereby C.E.'s wife will check on him periodically or he can call for help.
 - Show C.E. how to check his equipment on a daily basis.

PART 1 MEDICAL-SURGICAL CASES

- Have C.E. and his wife practice breathing relaxation exercises to keep him from panicking in emergencies.
 - The benefits of pulmonary rehabilitation cannot be stressed enough. They address quality-of-life issues.
 - Explore the possible benefits of a remote alarm system in which the patient wears the alarm button on a lanyard around the neck, so that help can be summoned quickly in the event of an emergency.
- 13.** C.E.'s wife asks you what her husband can do to help her around the house. She says, "The doctor told him to go home and take it easy. He sits in a chair all day. He won't even get up to get himself a glass of water. I've got a bad hip and this has been very hard on me." How would you address her issue?
- COPD patients often experience difficulty with particular activities or under particular circumstances, such as climbing steps, inhaling fumes, doing anything that requires them to hold their arms over the head, bending over, and/or being in a humid environment (cooking and bathing). Therefore:
- Establish C.E.'s level of daily activity before he was placed on O₂. He should be able to do everything he did before he was placed on O₂.
 - Establish which activities C.E. is experiencing particular difficulty performing.
 - Tell him that his muscles will deteriorate if he doesn't use them ("use it or lose it"). Find out what he can reasonably accomplish.
 - Have C.E. and his wife negotiate a plan of daily activity for C.E. Function as a neutral third party.
 - Check to see whether they qualify for home help. If his spouse is feeling overwhelmed, also consider recruiting outside help, such as from family or friends.
- 14.** What referrals could you consider at this time?
- Call the physician and request an OT consultation. The OT can show C.E. and his wife how to accomplish tasks in the most energy-efficient way.
 - Pulmonary rehabilitation program for all patients with moderate to severe lung disease.
- 15.** C.E. states, "You seem to know what you are talking about, so let me ask you something. I wake up with a headache almost every morning. My wife says it's because I snore so loud and don't breathe right when I sleep. Do you know anything about that?" After asking several questions, you inform C.E. that it sounds like he might not be getting enough O₂ at night. Explain the connection between hypoxemia and morning headaches.
- Lack of adequate O₂ causes arterial O₂ levels to decline and carbon dioxide levels to increase. Increasing carbon dioxide levels causes vasodilation in the brain, and C.E. wakes up with a headache.
 - An oximetry study is needed to determine whether C.E. is hypoxemic or has obstructive sleep apnea.

CASE STUDY PROGRESS

C.E. seems impressed by your explanation. He asks whether there is anything that can be done for his problem. You inform him that the first step is to identify the problem. You report to the covering health care provider, and an oximetry study is ordered. You comment that C.E. sounds like he has a cold. He replies, "Oh, our great-grandchildren were over to visit several days ago and they all had snotty noses. I suspect that I'll get it pretty soon. The problem is, every time I get a cold it goes straight to my lungs."

- 16.** What information would you want to review with C.E. and his wife about the signs and symptoms of infection and when to seek treatment?
- Signs include an increase in quantity or a change in color or consistency of sputum, a cough, or an increase in coughing.
 - Symptoms are fever, aching, tightness in the chest, fatigue, and weakness. Note that infections do not always cause fevers in older patients.
 - He should seek treatment as soon as he experiences symptoms. Early intervention might prevent an upper respiratory tract infection from becoming a lower respiratory tract infection and, possibly, pneumonia.
- 17.** What basic hygiene measures can C.E. and his wife take to prevent his developing an infection? (List at least four.)
- Practice good handwashing technique, and wash hands often.
 - Avoid people with infections (colds, flu); screen visitors.
 - Avoid enclosed, public areas during cold and flu season.
 - Get a pneumonia vaccine every 5 years and a yearly flu vaccine.
 - Be cautious around children who are in day care (an incredible reservoir of infectious resources).
 - Use separate towels in the home.
 - Use an automatic dishwasher to wash eating utensils, glasses, and plates at a higher temperature.
 - Use Lysol or Clorox wipes daily on all surfaces that you touch frequently: toilet lever, door handles, telephones, faucets, countertops, etc. Wash hands before and after touching your face, especially mucous membranes.
- 18.** Why is it important for people with lung disease to seek early intervention for infection?
Invading organisms cause damage to lung tissue. People like C.E. do not have a lot of lung reserve and can suffer temporary or permanent loss of function from a pulmonary infection.
- 19.** C.E.'s wife says she would like to read more about emphysema on the Internet. List an authoritative Internet resource of professional and patient or family information on lung disease.
- The lung associations in the United States or Canada (or any of the larger countries):
- American Lung Association: <http://www.lungusa.org> (in the United States)
 - The Lung Association: <http://www.lung.ca> (in Canada)
 - National Heart, Lung, and Blood Institute: <http://www.nhlbi.nih.gov/index.htm> (in the United States)



Case Study 29 Emphysema

Difficulty: Advanced**Setting:** Hospital**Index Words:** emphysema, medications, nutrition, patient education, assessment

► Scenario

D.Z., a 65-year-old man, is admitted to a medical floor for exacerbation of his chronic obstructive pulmonary disease (COPD; emphysema). He has a past medical history of hypertension, which has been well controlled by enalapril (Vasotec) for the past 6 years, has had pneumonia yearly for the past 3 years, and has been a 2-pack-a-day smoker for 38 years. He appears as a cachectic man who is experiencing difficulty breathing at rest. He reports cough productive of thick yellow-green sputum. D.Z. seems irritable and anxious; he complains of sleeping poorly and states that lately feels tired most of the time. His vital signs (VS) are 162/84, 124, 36, 102° F, SaO_2 88%. His admitting diagnosis is an acute exacerbation of chronic emphysema.

■ Chart View

Physician's Orders

Diet as tolerated
 Out of bed with assistance
 Oxygen (O_2) to maintain SaO_2 of 90%
 IV of D5W at 50 ml/hr
 ECG monitoring
 Arterial blood gases (ABGs) in AM
 CBC with differential now
 Basic metabolic panel (BMP) now
 Chest x-ray (CXR) q24h
 Sputum culture
 Albuterol 2.5 mg plus ipratropium 250 mcg nebulizer treatment STAT

1. Explain the pathophysiology of emphysema.

Emphysema results from several factors:

- Small airways undergo repeated cycles of inflammation and repair that increase collagen and scar tissue in the walls of the airways. These changes narrow the airway lumen and produce a fixed airway obstruction.
- Elastic fibers in the alveolar walls are tethered to small airways and hold the airways open during expiration. Destruction of the alveolar membrane results in premature closure of the terminal airways and air trapping during expiration.

2. Are D.Z.'s vital signs and SaO_2 appropriate? If not, explain why.

- His BP is elevated; normal BP parameters are less than 130/80 mm Hg for nondiabetics.
- Pulse is tachycardic (124 beats/min).
- Respirations are rapid (36 breaths/min) because of hypoxemia.
- Temperature is elevated and may indicate an inflammation or infection.

PART 1 MEDICAL-SURGICAL CASES

- Oximeter reading is low (88%) because of poor diffusion of O₂ across alveolar membrane.
 - Hypoxemia has contributed to anxiety, and anxiety is making the hypoxemia worse.
3. Describe a plan for implementing these physician's orders.
Using an ABCDs (Airway, Breathing, Circulation, Disability) system, the first action is initiate oxygen at 2L per nasal cannula and administer the albuterol 2.5 mg plus ipratropium 250 mcg nebulizer treatment. Place the patient on an ECG monitor and initiate the IV fluid. Obtain the CXR and blood work, and perform a physical assessment. Obtain the sputum culture as soon as the patient can provide a specimen. At the nurse's discretion, allow D.Z. out of bed and order a diet tray.
4. Identify three independent nursing actions you would try to improve D.Z.'s oxygenation.
- Positioning:** Seat patient in a chair that has arm rests. Elevating his arms lifts the ribcage so the respiratory muscles don't have to accomplish the work; this position decreases the work of breathing and allows greater lung expansion.
- Diaphragmatic breathing:** Encourage the patient to think about coordinating breathing to provide maximum lung expansion.
- Pursed-lip breathing:** This may increase pressure throughout the airways and allow airways to stay open longer; more air may be expelled.
- Relaxation:** Anxiety can increase the patient's sense of dyspnea; try controlled relaxation breathing exercises and/or biofeedback. You may need to ask the provider for an anxiolytic. Consider buspirone (BuSpar) for anxiety because it does not depress respirations or dry secretions.

■ Chart View

Medication Administration Record

Methylprednisolone (Solu-Medrol) 125 mg IVP q8h
 Doxycycline (Doryx) 100 mg PO q12h × 10 days
 Azithromycin (Zithromax) 500 mg IVPB q24h × 2 days then 500 mg PO × 7 days
 Fluticasone/salmeterol (Advair) 100/50 mcg 2 puffs bid
 Heparin 4000 units subcut q12h
 Enalapril (Vasotec) 10 mg PO q AM
 Albuterol 2.5 mg/ipratropium 250 mcg nebulizer treatment q6h

5. Indicate the expected outcome for D.Z. that is associated with each of the medications he is receiving.
- Methylprednisolone (Solu-Medrol) is an anti-inflammatory medication that will be used to decrease inflammation of the airways.
 - Azithromycin (Zithromax) and doxycycline are broad-spectrum antibiotics, which will kill or suppress the growth of microorganisms, including those causing respiratory infections.
 - Albuterol is a fast-acting, beta-2 agonist that acts to relax and open airways and increase ciliary movement to help clear secretions. Ipratropium is an anticholinergic that causes bronchodilation and inhibits secretions without causing systemic anticholinergic effects. The combination is more effective than either drug alone.
 - Fluticasone/salmeterol (Advair) 100/50 is a combination drug containing a low-dose inhaled steroid (fluticasone 100 mcg) that decreases the inflammation of the airways and a long-acting beta agonist (salmeterol 50 mcg) that acts as a bronchodilator. This pairing is useful in reducing swelling, mucus production, and spasm in/of the airways resulting in the easing of airway constriction.
 - Heparin is an anticoagulant that will be used to prevent deep vein thromboses.
 - Enalapril (Vasotec) is a calcium channel blocker that will be used to control D.Z.'s blood pressure.

6. Since D.Z. is on azithromycin (Zithromax), what nursing actions need to be added to the plan of care? Select all that apply.
- Monitor IV site for inflammation or extravasation
 - Assess liver function studies and bilirubin levels
 - Obtain a hearing test prior to initiating therapy
 - Carefully dilute the medication in the proper amount of solution
 - Place D.Z. on intake and output
 - Administer the medication over one-half hour

Answers: A, B, D, E

Thrombophlebitis is a common adverse effect associated with IV administration. The nurse will need to monitor the IV site closely; diluting the medication in the proper amount of solution for administration and administering over a minimum of one hour will lessen this risk. Because hepatotoxicity is a common adverse effect associated with the use of azithromycin; the nurse must monitor the results of liver function studies. Use of azithromycin is also associated with the potential for nephrotoxicity, as well as drug-induced diarrhea. Carefully monitoring intake and output will assist in early identification of these problems. Therapy typically is not associated with ototoxicity.

7. D.Z. is ordered heparin 4000 units subcutaneous q12 hr. The following vial is available. How many milliliters will D.Z. receive? Shade in the dose on the tuberculin syringe.

Answer: 0.8 mL (4000 units/x : 5000 units/1 mL)

N 0469-1262-15 926201

HEPARIN SODIUM

INJECTION, USP

5,000 USP Units/mL

(Derived from Porcine Intestinal Mucosa)

For IV or SC Use

1 mL Multiple Dose Vial

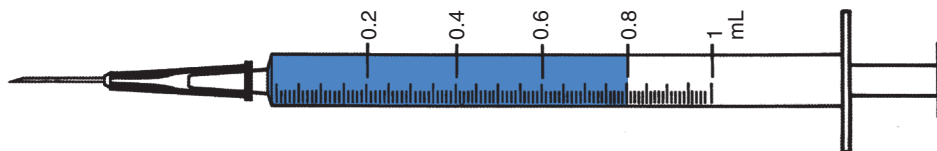
Usual Dosage: See insert.

Fujisawa USA, Inc.
Deerfield, IL 60015-2548

40213F

LOT

EXP



PART 1 MEDICAL-SURGICAL CASES

8. What are two of the most common side effects of bronchodilators?
- Tremors
 - Tachycardia
 - Anxiety (a side effect of the medication and of tachycardia)
9. Identify three outcomes that you expect for D.Z. as a result of your interventions.
- Subjective reports of absence of dyspnea at rest and minimal DOE
 - A decrease in respiratory rate and an increase in depth of respirations
 - A return to prehospital ABGs
 - Clear lung sounds
 - Vital signs within normal limits
10. You deliver D.Z.'s dietary tray, and he comments how hungry he is. As you leave the room, he is rapidly consuming the mashed potatoes. When you pick up the tray, you notice that he hasn't touched anything else. When you question him, he states, "I don't understand it. I can be so hungry, but when I start to eat, I have trouble breathing and I have to stop." One theory for the increased work of breathing is based on carbohydrate (CHO) loading. Explain this phenomenon based on your knowledge of the breakdown of CHO.
- CHO breaks down into CO_2 , which is eliminated by the respiratory system; increased CO_2 levels stimulate the respiratory system to increase respirations. The respiratory system is already taxed and is unable to meet the increased workload of the additional CHO. The patient experiences SOB and becomes anorectic.
 - Another theory is that food mechanically presses upward on the diaphragm and limits V_T and worsens SOB.
 - Alternatively, he may have eaten too quickly and became too tired to eat any more.
11. Identify four strategies that might improve his caloric intake.
- His diet should be 40% to 55% CHO, 30% to 40% fat, and 15% to 20% protein.
 - Provide 6 small meals per day that are concentrated with protein and calories.
 - Instruct him to eat more slowly to use less energy.
 - Encourage rest periods before and after meals.
 - Arrange for the family to bring the patient's favorite foods (try to avoid high CHO and high sodium, but keep in mind that most people don't know a CHO from a fat from a protein).
 - Include D.Z.'s wife in the discussion because problems with appetite often persist after discharge from the hospital.
 - Ask for a referral for medical nutrition therapy by an RD to work with D.Z. and his wife on dietary issues.
12. You notice a box of dark chocolate on D.Z.'s overbed table. He tells you that he wakes at night and eats 4 or 5 pieces of chocolate. Several of your COPD patients have identified a craving for chocolate in the past. What is the basis for this craving?
- Chocolate contains theobromine, which acts to relax smooth muscles, including those of the bronchioles. Milk chocolate contains 5 mg theobromine per ounce; cocoa, 5 to 10 mg/oz; and dark chocolate, 35 mg/oz.
13. What would you do to address dietary and nutritional teaching needs with D.Z. and his wife?
- Request that an RD consult with D.Z. and his wife concerning the specific needs and requirements of the COPD patient. The RD can help them individualize his MNT.
 - Contact the American Lung Association or American Lung Association website for patient and family education materials.

- 14.** List six other educational topics that you need to explore with D.Z.
- Infection control
 - Activity and exercise
 - Medication regimen, including importance of keeping a current list of medications and allergies with him
 - Fluid requirements
 - When to seek medical attention
 - Home O₂ therapy
 - Pulmonary hygiene
- 15.** What other health care professional would probably be involved in D.Z.'s treatments and how? What is the licensure or certification status of that profession in the state in which you are practicing?
- Most likely an RT would be involved in his care, particular in pulmonary toilet and administration of nebulization treatments. Call the occupational or professional licensing board in your state to determine the requirements for practice.

CASE STUDY PROGRESS

D.Z.'s wife approaches you in the hallway and says, "I don't know what to do. My husband used to be so active before he retired 6 months ago. Since then he's lost 35 pounds. He is afraid to take a bath, and it takes him hours to dress—that's if he gets dressed at all. He has gone downhill so fast that it scares me. He's afraid to do anything for himself. He wants me in the room with him all the time, but if I try to talk with him, he snarls and does things to irritate me. I have to keep working. His medical bills are draining all of our savings, and I have to be able to support myself when he's gone. You know, sometimes I go to work just to get away from the house and his constant demands. He calls me several times a day asking me to come home, but I can't go home. You may not think I'm much of a wife, but quite honestly, I don't want to come home anymore. I just don't know what to do."

- 16.** How would you respond to her statement?
- Reassure her that her experiences and feelings are typical of those expressed by many spouses of patients with COPD. Inform her about the Better Breathers Club (BBC) of the local chapter of the American Lung Association; tell her that the BBC offers education and social support for COPD patients and their families and significant others. Tell her that she needs to be able to vent her feelings and get advice from people who are in her same situation. Reinforce that this is something she has to do for herself.
 - Contact social services, who can arrange respite care for the wife, perhaps some home health aide to do light housekeeping and assist him in bathing. Spouses experience considerable suffering in living with someone with COPD. They are often left embittered, emotionally exhausted, and financially drained.



Case Study 30 Chronic Bronchitis and Lung Cancer

Difficulty: Advanced

Setting: Hospital

Index Words: chronic bronchitis and lung cancer, respiratory failure, pain management, assessment, National Patient Safety Goal, rapid response

► Scenario

The intensive care unit (ICU) nurse calls to give you the following report: “D.S. is a 56-year-old man with a past medical history of chronic bronchitis. He quit smoking 12 years ago and exercises regularly. He went to see his physician with complaints of increasing exertional dyspnea; a large mass was found in his right lung. Three days ago he underwent a right middle lobe (RML) and right lower lobe (RLL) lobectomy; the pathology report showed adenocarcinoma. He has no neurologic deficits, and his VS run 120/70, 110, about 30, and he has been running a fever of 100.2° F. His heart tones are clear, all peripheral pulses are palpable, and he has an IV of D 5 ½ NS at 50 mL/hr in his right forearm. He has a right midaxillary chest tube to Pleur-evac drain; there's no air leak, and it's draining small amounts of serosanguineous fluid. He has C/O pain at the insertion site, but the site looks good, and the dressing is dry and intact. He's on 5 L oxygen by nasal cannula. He refuses pain medication. He's a real nervous guy and hasn't slept since surgery. He'll be there in about 20 minutes.”

1. What additional information would you ask the nurse to provide at this time?

- What about lung sounds and oximeter readings?
- How is he tolerating the reduced lung volume?
- Does he have any allergies?
- Does he have any family who come to see him?
- Has he been eating, and what type of diet is he on?
- What are his elimination patterns? Has he voided? Moved his bowels?
- How are his I/O trends?

CASE STUDY PROGRESS

D.S. is transported by wheelchair past the nurses' station to a room at the far end of the hall. You enter his room for the first time to find him sitting on the edge of the bed with his left leg in bed and his right foot on the floor. You introduce yourself and tell him that you are going to be his nurse for the rest of the shift. You note that he keeps rubbing his left hand over the right side of his chest.

2. What issues or problems can you already identify?

- **Safety issues:** He is sitting on the edge of the bed and the side rails are down; he had surgery on the right side of his chest, and if he loses his balance, he won't be able to use the right arm to help stabilize himself.
- **Pain issue:** He is 3 days postoperative and has not received anything for pain.
- **Sleep issues:** He has not slept since surgery (3 days).

3. List four things you will do for D.S.

- **Raise the right side rails of the bed and explain your rationale.** (You cannot raise all four side rails as this is considered a restraint.)
- **Explain that your rooms are clustered at this end of the hallway, so you can keep an eye on all of your patients. This will lessen his sense of isolation.**
- **Obtain his VS, including SaO₂.**

PART 1 MEDICAL-SURGICAL CASES

- Perform a focused assessment. Evaluate lung sounds and chest tube site, all of the peripheral equipment, including oxygen, chest tube, and IV.
- Tell him that you understand that his chest tube is causing pain. Ask him to describe the pain. You want to know whether the pain is sharp/dull, constant/intermittent, or localized/generalized. Does the pain stay in one place or radiate someplace else? What relieves it, and what makes it worse? Investigate the reason he has refused to take pain medication since surgery.
- Give him the call light.

CASE STUDY PROGRESS

D.S. states, "I have a nephew who rolled his Jeep and busted himself up real bad. He got hooked on those drugs, and I don't want any part of them."

4. How would you respond to D.S.'s statement?
 - Inform D.S. that the purpose of pain is to tell you something is wrong with your body so that you can seek medical attention. Beyond that, pain serves no useful purpose. Pain medication is ordered to relieve the pain so that he can move around, cough and deep breathe, and recover faster. Moving and coughing will keep fluid from accumulating in his good lung (preventing pneumonia). Inform D.S. that patients who take pain medication recover more quickly and have fewer complications. Explain that if he waits until the pain is intense, it will take larger amounts of pain medication to relieve the pain. Tell him his body's response to pain can delay healing.
 - Explain that taking pain medication to relieve pain is different from taking medication to get high. You encourage all patients to take pain medication for the first 3 days after surgery; they need it to work the soreness out, and after that they don't need as much medication and can take only as much as they need. Tell him that the two of you have to work together so that he can get better and go home. Tell D.S. that you are going to get his pain medication, and ask him if he will let you administer it to him because you are going to encourage him to be more active.
 - Tell D.S. that you will wait until his pain is relieved before removing the chest tube dressing to observe the insertion site.
 - Discuss with D.S. nonpharmacologic methods of pain relief.
5. Why is D.S. experiencing difficulty using his right arm? Given the type of surgery he underwent, is this expected?

Yes, it is an expected outcome of this type of surgery. The patient is placed on the left side with the right arm placed anterior and superior to the head. The standard posterolateral thoracotomy incision begins just below the right nipple in front, curves posteriorly below the tip of the scapula, and extends slightly cephalad almost to the vertebral column in back. Then all intervening muscles are divided, and the long portion of the fifth rib or fourth and fifth ribs is dissected. Postoperatively, the patient suffers a transient nerve compression and restricted use of the arm on the affected side.
6. You administer morphine sulfate 4 mg IV and tell D.S. that you will return in 30 minutes; 15 minutes later he turns on his call light. When you enter the room, D.S. says, "I think I'm going to throw up." What are the next three things you would do?
 - Turn him onto his side to reduce the risk for aspiration.
 - Grab a basin and place it beside his mouth.
 - Provide a cool washcloth to his head.
 - Ask him when he began to feel nauseated.
7. D.S. states, "I started to feel sick a couple minutes ago. It just kept getting worse until I knew I was going to throw up." Given this information, what do you think is responsible for the sudden onset of nausea?

Nausea is most likely associated with the morphine.

8. Would it be appropriate to give D.S. a second dose of morphine before reporting his reaction to the physician? State your rationale. Describe your next steps.
- No, it would not be appropriate to subject D.S. to a second dose of morphine. There are many alternative medications that the physician could order.
 - Call the physician and describe your findings and observations during your initial assessment. Inform the physician that D.S. has not received anything for pain since surgery.
 - Describe the patient's reaction to the morphine sulfate and ask if D.S. could try fentanyl or hydrocodone.
 - Request something to relieve the nausea, such as ondansetron (Zofran).
9. D.S.'s pain and nausea are under control an hour later. You remove the chest tube dressing and note that the area around the insertion site looks slightly inflamed, the tissue immediately around the tube looks white and moist, and there is scant amount of brown drainage. What action would you take next?
- Wash around the chest tube with normal saline or sterile water, as directed by hospital policy, then dry area thoroughly. The skin around the tube could be macerated, so change the dressing more often.
 - Apply new petrolatum gauze around the insertion site, apply a sterile dressing, and tape the tube securely. A nonsecured tube can cause more damage.
 - If the maceration looks extensive or the insertion site looks infected, call the wound care specialist in your hospital.

CASE STUDY PROGRESS

The next day, the nurse giving you D.S.'s report says that he has been driving her crazy all day long. She tells you that he is fine but has been paranoid and demanding. You enter D.S.'s room to see how he is doing and to tell him you are going to be his nurse again today. You note that his head bobs up and his mouth opens, like a fish taking in water, every time he inhales. He says, "I just can't [breath] seem to [breath] get enough [breath] air."

10. Identify six possible problems that D.S. could have that would account for his behavior.
- Pneumonia
 - Mucous plug with distal atelectasis
 - Bronchoconstriction (exacerbation of asthma or chronic bronchitis)
 - Pulmonary embolus
 - Pneumothorax
 - Pulmonary edema (CHF)
 - ARDS
 - Splinting because of severe pain
11. What actions will you take next? Give your rationale.
- Increase his O₂ (start on 100% nonrebreather mask).
 - Obtain VS.
 - Auscultate breath sounds.
 - Note respiratory pattern.
 - Note recruitment of accessory muscles to breathe.

CASE STUDY PROGRESS

D.S.'s respiratory rate is 46 breaths/min; you auscultate slight air movement over the large airways and no breath sounds distal to the third intercostal space. He's sitting on the side of the bed with his arms hunched up on the overbed table. His gown is in his lap, he is diaphoretic, you note intercostal retractions with inspiration, and all muscles of the upper torso are engaged in respiration.

PART 1 MEDICAL-SURGICAL CASES

12. What will you do next?

Call for the rapid response team. His V_T is inadequate to support life; he is creating an O_2 deficit and could go into respiratory arrest at any moment.

13. After D.S. is successfully resuscitated, you accompany him during transfer to the ICU. Why would you do this, and what information would you provide to the ICU nurse?

An in-person, hand-off report would assist in meeting National Patient Safety Goal 2, which requires effective communication between health care professionals. You would first identify yourself, then explain that D.S. is experiencing respiratory distress. State that D.S. is postoperative day 4 following RML/RLL lobectomy for adenocarcinoma; then give current VS and details of his respiratory exam, including assessment items that are changing and the time period of those changes. You need to detail the interventions that D.S. has undergone and review his current status, including all of D.S.'s current care needs.

CASE STUDY PROGRESS

After stabilizing D.S. in the ICU, the physician returns to your floor and compliments you on your clear thinking and fast action. The nurse who gave you his report comes up to you to apologize. She is relatively new and asks you to explain how you know when a patient is in the early and late stages of respiratory difficulty. She states that she wants to learn from her mistakes so that she doesn't put another patient through what D.S. experienced.

14. How would you distinguish between early and late stages of respiratory failure?

Signs of Early Respiratory Failure

- Increased respiratory rate
- Decreased V_T
- Increased use of accessory muscles
- Breathlessness while talking
- Tachycardia
- Pulsus paradoxus 10 to 25 mm Hg
- Agitation
- Loss of sense of humor; energy and cognitive awareness focused on breathing

Signs of Late Respiratory Failure

- Respiratory rate over 30 breaths/min
- Breath sounds very decreased or absent
- Recruitment of all accessory muscles of respiration
- Muteness
- Inability to recline
- P_{aO_2} less than 55 mm Hg
- P_{aCO_2} over 45 mm Hg (acidosis—pH less than 7.3 and somnolence without cough)
- Paradoxical thoracoabdominal movement
- Cold, clammy skin

CASE STUDY OUTCOME

D.S. is completely recovered 5 months following the lobectomy. He receives 6 months of external beam radiation therapy to the chest. His chest x-ray at 5 years shows no recurrence.



Case Study 31 Adult Respiratory Distress Syndrome

Difficulty: Advanced

Setting: Hospital

Index Words: adult respiratory distress syndrome (ARDS), medications, pain management, assessment, laboratory values, dysrhythmias, crisis management

► Scenario

G.S., a 36-year-old secretary, was involved in a motor vehicle accident; a car drifted left of the center line and struck G.S. head-on, pinning her behind the steering wheel. She was intubated immediately after extrication and flown to your trauma center. Her injuries were found to be extensive: bilateral flail chest, torn innominate artery, right hemothorax and pneumothorax, fractured spleen, multiple small liver lacerations, compound fractures of both legs, and probable cardiac contusion. She was taken to the operating room for repair of her injuries. In OR, she received 36 units of packed RBCs, 20 units of platelets, 20 units of cryoprecipitate, 12 units fresh frozen plasma, and 18L of lactated Ringer's solution. G.S. was admitted to the ICU postop, where she developed adult respiratory distress syndrome (ARDS).

1. What is ARDS?

ARDS is the most severe form of acute respiratory failure. It occurs within hours to days of the initial insult. The overwhelming pulmonary injury and infection cause a massive release of inflammatory and thrombotic mediators that result in widespread systemic organ damage. Most people die of multisystem organ failure.

2. What are the risk factors for developing ARDS? Which does G.S. have?

The most common cause of ARDS is sepsis. Other risk factors include chest trauma, DIC, pneumonia, embolisms, inhalation of toxic substances, near-drowning, acute pancreatitis, anaphylaxis, cardiopulmonary bypass, history of multiple blood transfusions, opioid drug overdose, severe head injury, and shock states. G.S. received multiple blood transfusions and suffered extensive trauma.

CASE STUDY PROGRESS

G.S. has been in ICU for 6 weeks, and her ARDS has almost resolved. She is transferred to your unit. You receive the following report: She is awake, alert, and oriented to person and place and can move both of her arms and wiggle her toes on both feet. Heart tones are clear, vital signs are 138/90, 88, 26, 99.3° F (37.4° C); bilateral radial pulse 3+, and foot pulses by Doppler only. All of her incisions and lacerations have healed. She has bilateral chest tubes to water suction with closed drainage, both dressings are dry and intact. She has a duodenal feeding tube, a Foley catheter to down drain, and a double lumen PICC line.

3. What additional information will you require during this report?

Neurologic: Does she have any motor or sensory deficits? Pupil reactivity? Can she see to read? Does she wear or have glasses? Is she experiencing any pain?

CV: Has she been febrile? What is her cardiac rhythm? Any edema?

Skin: What is the skin condition, breakdown? Complications of surgery? Pins or other tubes?

Respiratory: Is she on O₂? What has her Sao₂ been running? Any chest drainage? How much suction to chest drainage system? Breath sounds? Coughing? Have any cultures been positive? If so, what organism? Any respiratory treatments? Last CXR? Any respiratory distress?

GI: What type of tube feeding and rate of infusion? Any guaiac plus drainage from anywhere? Any stools, bowel sounds? When was her last BM? Have her describe it (soft/hard, formed/loose, large/small, etc.). How is her weight?

PART 1 MEDICAL-SURGICAL CASES

GU: What does her urine look like? What is the output? What was the date of her last Foley change? What is her renal function?

General: Allergies and PMH? Are there any family members? If so, any problems with them? Belongings? What medicine is she on?

CASE STUDY PROGRESS

You complete your assessment of G.S. You note shortness of breath (SOB), fine crackles throughout all lung fields posteriorly and in both lower lobes anteriorly, and coarse crackles over the large airways.

4. What is the significance of the fine and coarse crackles in G.S.'s case?
 - Fine crackles indicate fluid accumulation in the pulmonary tissues (parenchyma) that might result in impaired gas exchange. Edematous parenchymal tissue exerts pressure on distal airways; when parenchymal pressure exceeds intra-airway pressure, the airways prematurely collapse or pop closed. Conversely, when intra-airway pressure exceeds parenchymal pressure, the airways pop open. The vibrations of distal airways popping closed and open are carried to the outer chest wall and are heard as crackles.
 - Coarse crackles indicate secretions in the large airways. Vibrations caused by air passing around or through the secretions are carried to the outer chest wall and are heard as coarse crackles.
5. The nurse from the previous shift charted the following statement: “Fine and coarse crackles that clear with vigorous coughing.” Based on your knowledge of pathophysiology, determine the accuracy of this statement.

It is possible to clear coarse crackles but physiologically impossible to clear fine crackles with coughing.
6. It is time to administer furosemide (Lasix) 40 mg IV push (IVP). What effect, if any, will furosemide have on G.S.'s breath sounds?

Furosemide, a diuretic, will mobilize and increase excretion of excess fluids from the body. Decreased parenchymal edema might result in fewer fine crackles.
7. What action should you take before giving the furosemide (Lasix)?

Check laboratory values, particularly Na, K, Mg, and ionized Ca.

Chart View

Laboratory Test Results at 0500

Sodium	129 mmol/L
Potassium	3.0 mmol/L
Chloride	92 mmol/L
HCO ₃	26 mmol/L
BUN	37 mg/dL
Creatinine	2 mg/dL
Glucose	128 mg/dL
Calcium	7.1 mg/dL

8. Keeping in mind that you are about to administer furosemide (Lasix), which laboratory values concern you, and why?
- Sodium, potassium, and calcium are low. Each of these laboratory values is likely to decrease after administering furosemide. Na levels affect BP and neuromuscular reactions. K is essential for the transmission of electrical impulses in cardiac and skeletal muscle. Ca is essential for muscle contraction and blood coagulation.
 - Mg was not drawn; however, because the Na, K, and Ca are low, you would want to check the Mg level.
 - The BUN and creatinine levels are slightly elevated; the possibility of renal impairment must always be considered in evaluating diuretic response to furosemide.
9. Given the laboratory values listed, what action would you take before administering the furosemide (Lasix), and why?
- Call the physician to report the abnormal laboratory values and state that no Mg level was drawn. Inform the physician that it is time to administer furosemide 40 mg IVP.

CASE STUDY PROGRESS

The physician prescribes the following:

■ Chart View

Physician's Orders

STAT magnesium (Mg) level
 KCl 40 mEq IVPB over 4 hours now
 Calcium gluconate 2 g in 100 mL NS intravenous piggyback (IVPB) over 3 hours

10. G.S. has one available port to use on the PICC line. Describe your plan for administering the potassium chloride and the calcium gluconate.
- Because the medications are compatible, it would be acceptable to administer each through a “Y” site connector into the PICC line with each infusion regulated by its own pump or controller. For the KCl, since no more than 10 mEq would typically be mixed per 100 mL normal saline, you would expect to administer four sequential bags of solution to total the 40 mEq dose ordered. During the infusion, you would need to ensure that G.S. is on a cardiac monitor, and you would monitor the infusion to ensure that it is not infusing too rapidly. Calcium gluconate, when administered as an infusion, should not exceed 200 mg/min, which is a rate that is lower than the prescribed infusion time of 3 hours. Although potassium chloride (KCl) and calcium gluconate are compatible and could be mixed in the same bag of NS, because exceeding the recommended speed of the infusion could be detrimental to the patient, it is not desirable to do so.
11. You open G.S.'s medication drawer, prepare the furosemide (Lasix) for administration, and find one 20-mg ampule. The pharmacist tells you that it will be at least an hour before he can send the drug to you. You realize it is illegal to take medication dispensed by a pharmacist for one patient and use it for another patient. What should you do?
- If you are unable to locate the furosemide and cannot send anyone to the pharmacy to obtain the drug, give the first 20 mg IVP, then give the second 20 mg when it is delivered. Realize that two 20-mg doses might not generate the same diuretic effect as one 40-mg dose. Compare the diuresis achieved with the two half-doses to that achieved with the single dose, and, if there is a discrepancy, inform the appropriate physician the next time a co-worker pages him or her.
 - Chart your actions and rationale.

PART 1 MEDICAL-SURGICAL CASES

12. While you administer the furosemide (Lasix) and hang the IVPB medication, G.S. says, “This is so weird. A couple times this morning, I felt like my heart flipped upside down in my chest, but now I feel like there's a bird flopping around in there.” What are the first two actions you should take next? Give your rationale.
- Connect G.S. to a monitor or call for a STAT 12-lead ECG.
 - Determine whether G.S. has a conducted pulse; note the rate and regularity.
 - If she has a pulse, take her BP and determine whether she is symptomatic.
 - Monitor the ABC. If she loses her pulse, call for help and begin CPR.
13. G.S.'s pulse is 66 beats/min and irregular. Her BP is 92/70 and respirations are 26. She admits to being “a little lightheaded” but denies having pain or nausea. Your co-worker connects G.S. to the code cart monitor for a “quick look.” This is what you see. What do you think is happening with G.S.?



G.S. is having frequent PVCs, including one four beat run of ventricular tachycardia.

14. What will your next actions be?
- Increase the O₂ concentration.
 - Hang the KCl and Ca gluconate IVPBs as quickly as possible, and begin the infusion.
 - Call for a STAT portable 12-lead ECG to confirm the PVCs.
 - STAT page the physician.
 - Call for STAT ABGs.
 - Make sure you have IV access—at least two 18-gauge lines or a central line.
15. What are the most likely causes of G.S. having abnormal beats?
- Low K, Ca, or Mg levels
 - Low O₂ levels

■ Chart View

Arterial Blood Gases on 6 L O₂ by NC

pH	7.30
Paco ₂	59 mm Hg
Pao ₂	82 mm Hg
HCO ₃	36 mmol/L
Sao ₂	91%

16. How would you interpret G.S.'s ABGs?

G.S. is experiencing respiratory acidosis, most likely because of poor perfusion related to her cardiac status. Her carbon dioxide level is high; her bicarbonate level is within normal limits. Her low Pao₂ level reflects poor pulmonary perfusion.

17. You notice that G.S. looks frightened and is lying stiff as a board. How would you respond to this situation?

Put your hand on G.S.'s arm and say something like this: "Let me tell you what is going on. As we get older, everyone has some abnormal heartbeats. It is not a problem as long as we don't have too many of them. When you told me you felt like you had a bird in your chest, I felt your pulse right away, and I could tell you were having too many of those abnormal beats. Those beats are usually caused by one of two things: either your heart muscle isn't getting enough oxygen, or you don't have enough of certain minerals such as potassium, calcium, or magnesium in your blood. We're trying to determine the reason you're having those abnormal beats. I've already turned up your oxygen, and the respiratory therapist drew your blood to see how much oxygen is in it. I've started an IV that has potassium and calcium in it, but I can't give it too fast because that could cause other problems. The lab technician drew your magnesium level about an hour ago, so we'll have that result soon. I'll keep you informed as we get more information." Then ask G.S. whether she has any questions and whether there is anything she needs. Give her the call light, and ask her to alert you immediately if she feels any changes. See if an aide can stay with her for a while.

CASE STUDY OUTCOME

G.S. responded well to treatment. Unfortunately, 1 week later she threw a large embolus. All attempts at resuscitation failed.

