

# 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, directly observed therapy (DOT), patient education

**Giddens Concepts:** Health Care Law, Infection, Patient Education, Safety

**HESI Concepts:** Assessment, Health Care Law, Infection, Patient Education, Safety

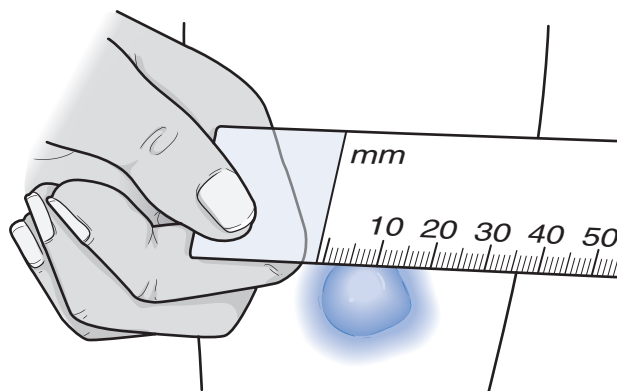
#### ► Scenario

You are a public health nurse working at a county immunization and tuberculosis (TB) clinic. B.A. is a 51-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 result before being hired. She came to your clinic 2 days ago to undergo 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, an infectious disease caused by *Mycobacterium tuberculosis*, or *M. tuberculosis* for short, an acid-fast, gram-positive bacillus. TB is a communicable disease; it is a requirement to report cases to the Centers for Disease Control and Prevention (CDC).**
2. What is the route of transmission for TB?  
**TB spreads by airborne droplet transmission.**
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 spent time with someone who has TB**
  - **Alcoholics and intravenous (IV) drug abusers**
  - **Residents and staff of acute and long-term care facilities, prisons, detention facilities, homeless shelters, and residential facilities.**
  - **Those with human immunodeficiency virus (HIV) infection or another chronic disease associated with immunosuppression.**
  - **Medical personnel who work in mycobacteriology laboratories.**
4. Describe the two methods of 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 dorsal surface 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 48 to 72 hours later 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. Two IGRAs are approved by the U.S. Food and Drug Administration and are available in the United States: the QuantiFERON–TB Gold In-Tube test (QFT-GIT) and the T-SPOT.TB test (T-Spot).
5. How do you determine whether a Mantoux test result 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 a 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; persons who have a chest x-ray (CXR) study that shows old, healed TB; and 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; individuals from medically underserved, low-income populations; residents of long-term care facilities; people with chronic illnesses; mycobacteriology laboratory personnel; and all children and adolescents.
    - A PPD induration greater than 15 mm is considered positive for all other persons.



6. Interpret B.A.'s skin test.  
B.A.'s test result is positive because the area of induration is greater than 15 mm.
7. What additional information do you need to obtain from B.A.?
- Take a medical history. Ask about the history of exposure to TB, signs and symptoms (S/S) of active TB infection, medications, and past medical history (PMH). Find out whether she has regular access to health care.
  - Consider any demographic factors, such as country of origin, age, ethnic group, or occupation, which may increase her risk for exposure to TB or to drug-resistant TB. Note her domestic and occupational conditions.
  - Ask about current symptoms, including a productive cough, night sweats, afternoon temperature elevations, weight loss, and pleuritic chest pain.
8. You inform B.A. of the test result. She asks you what the result means. How will you respond?  
B.A. has been exposed to infectious TB. Because previous testing results have been negative and this test result was positive, B.A. may have been exposed to active TB since her last negative Mantoux test result.

**CASE STUDY PROGRESS**

B.A. is a natural-born American and has no risk factors for TB infection according to the CDC guidelines. She has a 6-year history of type II diabetes mellitus that is well controlled with metformin (Glucophage). She admits that her mother had TB when she was a child but says she herself has never tested positive before. She is angry at the proposition that she might have TB and says, "I feel just fine and I don't think anything else is necessary."

9. What steps need to be done to determine whether B.A. has an active TB infection?

First, B.A. will need a CXR examination. 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 examination is abnormal and/or symptoms compatible with TB are present, the patient should undergo sputum smear and culture examinations. At least three sputum specimens should be submitted.

**CASE STUDY PROGRESS**

The physician orders a chest x-ray (CXR) examination and informs B.A. that the image is clear, showing no signs of active TB infection. He tells her that she has class 2 TB, or a latent TB infection (LTBI), and that he will report her condition to the local public health department.

10. What is a 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 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.

11. What parameters determine whether treatment is initiated for LTBI?

Persons in the following high-risk groups should be treated 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 patient
- Persons with fibrotic changes on chest radiograph consistent with old TB
- Patients with organ transplants or who are immunosuppressed

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 medical conditions that increase the risk of progression to active TB infection
- Children under 4 years of age, or children and adolescents exposed to adults in high-risk categories

12. Is B.A. a candidate for LTBI treatment? State your rationale.

Yes. Because B.A. had a response greater than 15 mm and has a history of type II diabetes, she is at greater risk for progressing to active TB infection and should receive treatment.

## PART 1 MEDICAL-SURGICAL CASES

13. Outline the current CDC guidelines for the treatment of LTBI.

The four current treatment regimens use isoniazid (INH), rifapentine (RPT), or rifampin (RIF). The first involve the administration of INH for 6 to 9 months, either daily or twice weekly. INH can be combined with RPT and administered once weekly for a minimum of 12 weeks. The last regimen consists of monotherapy with RIF daily for 4 months. Treatment must be modified if the patient is a contact of an individual with multidrug-resistant TB or is HIV positive.

## CASE STUDY PROGRESS

The physician orders B.A. to begin a 12-dose, once-weekly regimen of isoniazid (INH) and rifapentine (RPT) as directly observed therapy (DOT).

14. How will you describe LTBI and DOT to B.A.?

Explain the disease process and rationale for therapy in the absence of symptoms and radiographic abnormalities. Review the importance of completing therapy.

Tell her she will need to come to the clinic weekly to take her medications. Coinciding with those visits, she will undergo monitoring that includes weekly inquiries about side effects and monthly physical assessment for signs of adverse events, including hepatitis.

15. The medications used to treat LTBI 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 (complete blood count)                                      |
| ___ C. Fever and bleeding problems     | 3. Blood urea nitrogen (BUN), creatinine, and creatinine clearance |
| ___ D. Nephrotoxicity or renal failure | 4. AST (aspartate transaminase) and ALT (alanine transaminase)     |
| ___ E. Hyperuricemia                   | 5. Physical examination 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

Physical examination and monofilament testing are used to test sensation in the lower extremities. Clinical hepatitis may be detected by elevations in AST and ALT with a positive hepatitis C titer. Upward deviations in the white blood cell (WBC) count 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.

16. What additional information does B.A. need to receive before leaving the clinic?
- Review the side effects of INH and RPT therapy. Instruct B.A. to seek medical attention immediately if she develops a fever, yellow eyes, dizziness, rash, or aches or more than 1 day of nausea, vomiting, weakness, abdominal pain, or loss of appetite.
  - She needs to know the S/S of active TB in case her TB becomes active, including fever, night sweats, fatigue, anorexia, and weight loss.
  - She should be told that she will always have a positive TB skin test result because she has been exposed. The only way to determine whether she has active disease is by CXR examination.

**CASE STUDY OUTCOME**

B.A. is hired under the condition that she complies with LTBI therapy and will immediately report any signs and symptoms of active disease to the clinic. She reports weekly for her medications and finishes her 12 weeks of therapy without experiencing any significant effects.





## Case Study 19 Atelectasis

**Difficulty:** Beginning

**Setting:** Hospital

**Index Words:** atelectasis, acute cholecystitis, postoperative care, chest x-ray (CXR), incentive spirometer (IS), medications, patient education, oxygen therapy

**Giddens Concepts:** Clinical Judgment, Collaboration, Gas Exchange

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Collaboration/Managing Care, Gas Exchange, Nursing Interventions, Oxygenation

### ► Scenario

It is 1130 and M.N., age 65, is being admitted to your surgical floor after having undergone an open cholecystectomy for acute cholecystitis. She has a nasogastric tube to continuous low wall suction, one peripheral intravenous (IV) line, and a large abdominal dressing. Her orders are as follows.

### Chart View

#### Physician's Orders

Clear liquid diet; progress 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  
 Oxygen per protocol to maintain SpO<sub>2</sub> at 95%  
 Dangle in AM  
 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 remain on nothing-by-mouth (NPO) status and not receive a diet order until she resumes bowel sounds and passes flatus. It usually takes 48 to 72 hours for the bowels to resume peristalsis after abdominal surgery. Then the nasogastric tube will be removed and M.N. can start eating.
  - You need to know M.N.'s potassium level before administering an infusion containing this level of potassium.
  - Morphine sulfate should be given intravenously in small doses (1 to 2 mg) at more frequent intervals (q1- 2h as needed). IM (intramuscular) injections are both painful and unnecessary.
  - M.N. should dangle the evening of surgery and be out of bed to a chair and progressively ambulating beginning the next day.

## PART 1 MEDICAL-SURGICAL CASES

## CASE STUDY PROGRESS

At 1530, the nursing assistive personnel (NAP) reports 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)
SpO <sub>2</sub>	92%

- Based solely on her vital signs, what 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 an inflammatory response from having infection (cholecystitis on admission) or a normal postoperative reaction.
  - Her oxygen saturation 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 go to assess M. N. What do you need to include in your assessment at this time?
  - Observe her general status. Is she restless or agitated? Is she alert and oriented in all spheres?
  - Observe the color of her skin. Is it pale, flushed, cyanotic? Is she diaphoretic? Cool? Are respirations labored? Is she using accessory muscles? Can you see her chest significantly rising and falling? Ask her how she feels as she is breathing—does she feel short of breath?
  - Auscultate and percuss her lung fields. Check her capillary refill time.

## CASE STUDY PROGRESS

Your assessment of M.N. finds her with 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. Her skin is pale, warm, and dry. She does not have a productive cough, chest pain, or any anxiety.

- What complication do you suspect M.N. is experiencing? State your rationale.
 

M.N. appears to be developing atelectasis. She has the common presenting symptoms of dyspnea and hypoxia, accompanied by fever, crackles, and diminished breath sounds. Pneumonia typically does not occur this early; the common signs of pulmonary embolism M.N. does not have include anxiety, pleuritic chest pain, cyanosis, and hypoxia.
- Why is M.N. at risk for developing this complication?
 

The effects of anesthesia, reluctance to cough and deep breathe because of inadequate pain control and location of the surgical incision, and immobility contribute to the inadequate lung expansion that predisposes patients to developing atelectasis.
- What is your nursing priority at this time?
 

The nursing priority right now is to improve M.N.'s respiratory status.
- Describe six interventions you will perform over the next few hours based on this priority.
  - Apply the oxygen per protocol because her SpO<sub>2</sub> is below 95%.
  - Elevate the head of her bed.



- Administer pain medication if the time interval is appropriate. Tell her that you are going to let her rest for 20 minutes until the morphine has had time to take effect; then you will be back to help her dangle, use the incentive spirometer (IS), and cough and deep breathe.
  - Have her cough and deep breathe every hour, splinting her incision. If needed, review with her appropriate technique and coach her while she coughs.
  - Explain and demonstrate the correct use of the IS. Have her use the IS every hour while awake.
  - Have her dangle on the side of the bed as ordered.
  - Turn and reposition every 2 hours.
  - Reassess her vital signs every 2 hours and monitor for signs of deterioration.
  - Be prepared to call a physician if her condition worsens.
8. To promote optimal oxygenation with M.N., which action(s) could you delegate to the NAP? Select all that apply.
- a. Reminding M.N. to cough and deep breathe
  - b. Instructing M.N. on the use of incentive spirometry
  - c. Assisting M.N. in getting up to the chair
  - d. Taking M.N.'s temperature and reporting elevations
  - e. Encouraging M.N. to splint the incision
  - f. Auscultating M.N.'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 the 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 registered nurse (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
  - Sp<sub>o</sub><sub>2</sub> greater than 90%
  - Afebrile status
  - Resonant percussion

### CASE STUDY PROGRESS

At 1830, the NAP reports the following.

#### Chart View

##### Vital Signs

Blood pressure	136/72 mm Hg
Heart rate	104 beats/min
Respiratory rate	24 breaths/min
Temperature	100.6° F (38.1° C)
Sp <sub>o</sub> <sub>2</sub>	93%

**PART 1 MEDICAL-SURGICAL CASES**

10. Has M.N.'s status improved or not? Defend your response.  
Although there has been a slight decline in heart rate and temperature and a slight increase in oxygen saturation, M.N.'s vital signs are still abnormal and reflect that she has possibly developed atelectasis or another pulmonary complication.
11. You need to call the physician regarding M.N.'s status. Using SBAR (Situation, Background, Assessment, Recommendation), what would you report to the physician?  
Following SBAR, you would first need to identify yourself and the patient. Then you would describe the situation, focusing on the Sp<sub>o</sub><sub>2</sub> 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 chest x-ray (CXR) examination is needed.
12. The physician orders a chest x-ray examination. Afterward, radiology calls with a report, confirming that M.N. has atelectasis. Should this diagnosis change your plan of care for M.N.?  
No. You should continue your plans and monitor effectiveness.
13. If M.N. had pneumonia, what changes might the physician have made to her plan of care?  
If M.N. had pneumonia, you would anticipate the physician ordering blood cultures, starting breathing treatments, and initiating antibiotic therapy.
14. 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?  
M.N.'s sister and perhaps M.N. are concerned that something might have gone wrong with M.N. during her hospitalization. State everything in positive terms because they need reassurance. 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 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.



## Case Study 20 Obstructive Sleep Apnea

**Difficulty:** Beginning

**Setting:** Clinic

**Index Words:** sleep apnea, symptoms, polysomnogram, sleep hygiene, continuous positive airway pressure (CPAP), durable medical equipment (DME), telephone triage, documentation

**Giddens Concepts:** Oxygenation, Patient Education

**HESI Concepts:** Assessment, Oxygenation, Patient Education

### ► Scenario

S.R. is a 59-year-old man who comes to the clinic because his wife complains “my snoring is difficult to live with.”

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

**Vital signs (VS) and O<sub>2</sub> 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), over-the-counter (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 2 years, leading to a current weight of 250 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 164/90, 92, 18, and Spo<sub>2</sub> 90% on room air. His examination findings are normal, except for a few bruises over the right side of the rib cage. 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. It may be seen with central nervous system (CNS) lesions, such as in stroke or brain stem trauma. Cheyne-Stokes respirations are common with this syndrome.

**Obstructive sleep apnea (OSA):** This type of apnea is more common. It is caused by airflow obstruction during sleep because of narrowed air passages from relaxed muscle tone or the tongue and the soft palate falling backward and partially or completely obstructing the pharynx. Each obstruction lasts from 10 to 90 seconds. During the apneic period, the patient develops hypoxemia and hypercapnia, which eventually stimulate respirations. The patient may arouse with a startle, snort, and/or gasp. These frequent awakenings interrupt the normal sleep cycle. The actual cause of OSA is unknown, but sleep apnea is a potentially life-threatening condition.

## PART 1 MEDICAL-SURGICAL CASES

3. Based on your findings, which type of sleep apnea do you believe S.R. has?  
S.R.'s history suggests a diagnosis of OSA.
4. Identify at least five signs or symptoms of this type of sleep apnea, and put a star next to 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\*
5. How does the provider use diagnostic testing to diagnose sleep apnea?
  - Thorough physical examination, focusing on an examination of the upper airway, is performed to detect any assessment abnormalities.
  - An overnight screening oximetry test is done to determine whether the patient desaturates during sleep.
  - Polysomnography is the gold standard for diagnosis, and it is often done if desaturation is detected during overnight screening oximetry. It is usually conducted in a sleep laboratory. A portable sleep study in the home may be done in certain circumstances.

## CASE STUDY PROGRESS

The primary care provider examines S.R. and documents a long soft palate, recessed mandible, and medium-sized tonsils. S.R. undergoes an overnight screening oximetry study, which shows 143 episodes of desaturation ranging from 68% to 76% with episodes of apnea. He is tentatively diagnosed with obstructive sleep apnea (OSA), 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 show 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, SpO<sub>2</sub>, 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. S.R. and his wife ask why they need to be concerned about OSA. You tell them that treating OSA is necessary to prevent which common complications? 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, and 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.

8. The provider asks you to teach S.R. about lifestyle changes that he could make immediately to help with his situation. Describe four priority topics you would address with S.R.
- **Begin efforts to lose weight.** He could immediately begin a walking program and start an appropriate diet.
  - **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.
  - **Elevate the head of bed.**
  - **Initiate smoking cessation efforts.** He can enroll in a smoking cessation program or use nicotine patches, gum, or prescription medications to help him stop smoking.
  - **Decrease caffeine intake.** He can start mixing his coffee with decaffeinated coffee to decrease the caffeine.

### CASE STUDY PROGRESS

The polysomnogram confirms S.R.'s diagnosis of OSA. At his 6-week follow-up visit, he reports 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.

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

**Appliances:** Mild OSA can be treated with use of 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 nasal pillow, nasal mask, or full-face mask.

**CPAP with O<sub>2</sub>:** This is the same as CPAP but with added O<sub>2</sub> through the machine or by nasal cannula. This method can be used with a nasal pillow, nasal mask, or full-face mask.

**Bilevel positive airway pressure (BiPAP):** BiPAP differs from CPAP in that it delivers two different levels of airflow, with a higher pressure given during inhalation and a lower pressure given during exhalation.

#### Surgical Options

**Tonsillectomy, with or without adenoidectomy, or a uvulopalatopharyngoplasty:** 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:** This may be performed for a congenitally small mandible.


**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 O<sub>2</sub> at night, thereby bypassing any upper airway obstruction. This treatment option is reserved for life-threatening sleep apnea.

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

### CASE STUDY PROGRESS

S.R. and the provider decide to begin S.R. on the least invasive treatment—continuous positive airway pressure (CPAP). The provider writes a prescription for CPAP.

## PART 1 MEDICAL-SURGICAL CASES

-  10. List three education topics you need to address with S.R. so he can safely self-manage CPAP therapy.
- S.R. needs to have a working knowledge of the CPAP system.
- How to apply the mask and connect it to the machine
  - How to manage the fit of CPAP mask or nasal device to reduce irritation and discomfort
  - Ways to decrease anxiety associated with wearing the CPAP system
  - How to perform daily equipment maintenance and clean the system
  - What to do in case of respiratory distress or other complications
11. S.R. calls 2 weeks later with complaints of dry nasal membranes, nosebleeds, and sores behind his ears. What instructions would you give S.R.?
- Ask the durable medical equipment (DME) company to check for proper fitting of the mask and tubing and whether adding humidification to his O<sub>2</sub> is possible.
  - Get saline nasal spray at any drugstore or make your own. Use two sprays in each nostril up to every 2 hours as needed. A recipe for ocean saline spray: Boil water 20 minutes and let cool. Then to 1 quart of water, add 1 teaspoon of salt, plus a pinch of baking soda. Store at room temperature in a covered container for up to 72 hours, and then discard.
  - Describe 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.
12. Describe how you will document the phone call with S.R.
- First, state the date and time of the phone call and who was on the phone providing information. Then describe the subjective information provided by S.R., providing enough detail to support the plan of action and justify that his problem can be managed without an in-person visit. In this case, you would document his complaints of dry nasal membranes, nosebleeds, and sores behind the ears, noting details of your assessment, such as when symptoms started and symptom severity. You would then detail the plan of action, describing the care instructions given him, concluding with when and how to seek additional care.



## Case Study 21 Acute Asthma Management

**Difficulty:** Intermediate

**Setting:** Outpatient clinic

**Index Words:** asthma, allergies, respiratory distress, patient education, assessment, aerosol treatment, inhaler

**Giddens Concepts:** Gas Exchange, Oxygenation, Patient Education, Safety

**HESI Concepts:** Assessment, Gas Exchange, Nursing Interventions, Oxygenation, Patient Education, Safety

### Scenario

B.T., a 31-year-old man who lives in a small mountain town in Colorado, is highly allergic to dust and pollen and has a history of mild asthma. B.T.'s wife drove him to the emergency room when his wheezing was unresponsive to his fluticasone/salmeterol (Advair) inhaler, he was unable to lie down, and he began to use accessory muscles to breathe. B.T. is immediately started on 4L oxygen by nasal cannula and intravenous (IV) D5W at 75 mL/hr. A set of arterial blood gases is sent to the laboratory. B.T. appears anxious and says that he is short of breath.

### Chart View

#### Vital Signs

Blood pressure (BP)	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 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 rationale for immediately starting B.T. on O<sub>2</sub>?

Bronchoconstriction has caused an increase in airway resistance and a decrease in tidal volume. The goal of therapy is to compensate by increasing the concentration of inspired O<sub>2</sub>.

3. Keeping in mind B.T.'s health history and presenting complaint, what are the most important areas you need to evaluate during your physical assessment?

**General:** Note his position: Is he upright or forward leaning? Does he appear restless or exhausted?

What is his mental status? Is he confused or agitated?

**Respiratory:** Auscultate lung sounds, listening for wheezing, crackles, diminished or absent breath sounds, and rhonchi. Percuss for any areas of hyperresonance. Observe for the presence of any sputum, increased work of breathing with use of accessory muscles or retractions, or prolonged expiration.

**Integumentary:** Note skin color and the presence of any diaphoresis.

**Cardiovascular:** Assess for the presence of pulsus paradoxus and jugular venous distention. Are there premature ventricular contractions or other dysrhythmias on the electrocardiogram (ECG)?

## PART 1 MEDICAL-SURGICAL CASES

## Chart View

## Arterial Blood Gases

pH	7.31
Paco <sub>2</sub>	48 mm Hg
HCO <sub>3</sub>	26 mmol/L
Pao <sub>2</sub>	55 mm Hg

4. Interpret B.T.'s arterial blood gas results.

B.T.'s pH indicates that he is acidotic. His Paco<sub>2</sub> 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 Pao<sub>2</sub> will be decreased at this altitude, his Spo<sub>2</sub> should be above 90%; the 88% Spo<sub>2</sub> and the Pao<sub>2</sub> of 55 indicate that hypoxemia related to the asthma attack is at a level that could indicate impending respiratory failure.

## 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 HFA) MDI: 220 mcg, 1 puff twice daily

5. 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<sub>2</sub> 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.


6. Indicate the drug classification and expected outcome B.T. should experience with using metaproterenol sulfate (Alupent) and Fluticasone (Flovent).

Metaproterenol sulfate is a short-acting beta<sub>2</sub> receptor adrenergic bronchodilator. It is used to reverse airway constriction caused by acute and chronic bronchial asthma. Because it has a rapid onset of action (a few minutes), it 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 reduce swelling, mucus production, and spasm in and of the airways, resulting in the easing of airway constriction.



**CASE STUDY PROGRESS**

You assess B.T. and find that he has diminished lung sounds with inspiratory and expiratory wheezes in all lung fields with a nonproductive cough and accessory muscle use. His skin is pale, warm and dry. The electrocardiogram (ECG) shows sinus tachycardia without ectopy. He is alert and oriented ×4 spheres. He appears anxious and is sitting upright, leaning over the bedside table, and continuing to complain of shortness of breath.

7. What is your primary nursing goal at this time?  
The nursing priority right now is to improve B.T.'s respiratory status.
8. Describe six actions you must implement based on this priority.
  - Administer respiratory medications as prescribed.
  - Maintain oxygen therapy.
  - Frequently measure vital signs with continuous pulse oximetry and ECG monitoring.
  - Perform respiratory assessment, auscultating lung sounds and observing chest movements, at least every hour.
  - Maintain IV therapy.
  - Place him in a minimum of a semi-Fowler's position.
  - Coach B.T. in relaxation and breathing techniques.
9. You will need to monitor B.T. closely for the next few hours. What is the most serious complication to anticipate?  
Respiratory failure.
10. Identify four signs and symptoms of this complication you will assess for in B.T.
  - Breathlessness at rest
  - Muteness
  - Respiratory rate greater than 30 breaths/min
  - Paradoxical thoracoabdominal movement
  - Few or absent breath sounds
  - Relative bradycardia
  - Absent pulsus paradoxus
-  11. When combination inhalation aerosols are prescribed without specific instructions for the sequence of administration, you need to be aware of the recommendations for safe drug administration. Describe 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. What are your responsibilities while administering aerosol therapy?  
Major nursing responsibilities during aerosol therapy are 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

## CASE STUDY PROGRESS

After several hours of rehydration and aerosol treatments, B.T.'s wheezing and dyspnea 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 × 5 days), fluticasone/salmeterol (Advair HFA 230/21) two inhalations every morning and evening, albuterol (Proventil) metered-dose inhaler (MDI) two puffs q6h as needed using a spacer, and montelukast (Singulair) 10 mg daily each evening. He instructs B.T. to 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. How does montelukast (Singulair) differ from other asthma medications?

Singulair is a leukotriene receptor antagonist (LTRA). Through binding to the  $D_4$  leukotriene receptor subtype in respiratory tract tissues and other organs, LTRAs prevent smooth muscle contraction of the bronchial airways, decrease mucus secretion, and reduce vascular permeability that reduces edema. Other antileukotriene effects of these drugs include prevention of the mobilization and migration of such cells as neutrophils and lymphocytes into the lungs. The result is a reduction in asthma symptoms through a decrease in airway inflammation. LTRAs are not used for the reversal of an attack and need to be taken even when the patient is asymptomatic because they require 24 hours to achieve maximal effects.

15. B.T. states he had taken his Advair that morning, then again when he started to feel short of breath. He states, "It did not help," and wants to know why he has to remain on it. 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: 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 and of the airways. For Advair to be most effective, it needs to be used regularly.

16. Based on this information, what specific issue do you need to address in discharge teaching with B.T.?

Educate B.T. and his wife on the medications, dosages, and uses, stressing which medications are for acute attacks. Describe how Advair is used for day-to-day control but that it will not adequately open his airways during an asthma attack. The albuterol (Proventil) is a fast-acting inhaler that will help him open his airways when he is experiencing symptoms.

**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.

17. 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
18. You review the proper use of an MDI with B.T. and possible side effects he may experience, including hoarseness, dry mouth, white spots in the oral cavity, coughing, and headaches. What actions can you teach him to prevent or diminish the incidence of these effects? Select all that apply.
- a. Decrease his fluid intake.
  - b. Use a spacer on the inhaler.
  - c. Use the inhaler only as prescribed.
  - d. Rinse out his mouth immediately after using the inhaler
  - e. Clean the spacer in the dishwasher on “hot cycle with heated dry” daily.

Answers: b, c, d

Spacers will help him get appropriate doses of his medicine, assisting with controlling symptoms. An added benefit is that he will not have to worry about timing his breathing with the discharge of the canister. Caution him against exceeding the prescribed doses, because central nervous system and cardiovascular symptoms can occur. Rinsing his mouth with water or gargling after each use of the inhaler will help to prevent mucosal dryness and decrease risk of fungal infections. Increasing his fluid intake may assist with chronic coughing and hoarseness. Instruct him to clean the MDI and spacer daily in warm water and place them on a paper towel to air dry.

19. 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. The chance of this happening can be reduced by avoiding factors, or triggers, that seem to bring on an exacerbation or attack and properly using the medications prescribed by the doctor.”
20. B.T. states that he would like to read more about asthma on the Internet. List three credible websites to which you could direct him.  
 Credible websites include those maintained by the National Institutes of Health ([www.nhlbi.nih.gov](http://www.nhlbi.nih.gov)); the Asthma and Allergy Foundation of America ([www.aafa.org](http://www.aafa.org)); the National Library of Medicine ([www.nlm.nih.gov/medlineplus/asthma.html](http://www.nlm.nih.gov/medlineplus/asthma.html)); and the Centers for Disease Control and Prevention ([www.cdc.gov/asthma](http://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

**Giddens Concepts:** Gas Exchange, Health Promotion, Oxygenation, Patient Education

**HESI Concepts:** Assessment, Gas Exchange, Health Promotion, Nursing Interventions, Oxygenation, Patient Education

### ► Scenario

L.B. is a 40-year-old woman who is being seen in the clinic with complaints of a dry, hacking cough for the past 6 weeks.

- As the intake nurse, what routine information do you want to obtain from L.B.?
  - Vital signs (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 them, 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 shortness of breath (SOB)?
  - Is your cough worse with exercise, 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 or immediately after a respiratory infection?

## CASE STUDY PROGRESS

L.B. says that the cough is worse at night and is associated with shortness of breath. The cough began approximately 6 weeks ago after she recovered from bronchitis. She runs 3 miles four times a week and reports occasionally experiencing a “coughing spell” after running. 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. She does not smoke and is not taking any medication other than a multivitamin.

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

*VS: Respiratory effort, respiratory rate, and oximetry to evaluate respiratory function.*

*Ear, nose, and throat (ENT): Because of the correlation between asthma and allergic rhinitis, observe for findings associated with allergic rhinitis including pale, boggy turbinates, serous otitis, and 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 for wheezing to be heard. Patients with chronic obstructive pulmonary disease (COPD) often have distant breath sounds; patients with pneumonia may have crackles, wheezes, and egophony.*

*Lymph node palpation: To determine if an infection of the upper respiratory tract may be responsible for her symptoms.*

*Abdominal palpation: Look for gastric tenderness that often accompanies gastroesophageal reflux disease (GERD), which is a frequent asthma trigger.*

*Skin: Eczema can be an atopic manifestation of asthma.*

## CASE STUDY PROGRESS

L.B. is not in any acute distress. Vital signs (VS) are 110/60, 55, 18. She has no sinus tenderness, ear examination findings are negative, nasal mucosa is pale and boggy, mouth examination findings are negative, there is no cervical adenopathy, and lungs are clear to auscultation. Forced expiration using the peak flow meter (PFM) generates a cough. Her peak flow is 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 predilator and postdilator pulmonary function tests (PFTs). What is the purpose of completing predilator and postdilator PFTs?

*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. After the PFT, L.B. is diagnosed with mild persistent asthma. She returns to the clinic so that a plan for managing her asthma can be established. What priority topics need addressed?

- Describe the basic pathophysiology of asthma and provide an overview of its management.
- Explain what each medication is, why she is taking it, and its appropriate use.
- Demonstrate PFM and metered-dose inhaler (MDI) technique and ask for a return demonstration.
- Teach her to identify and avoid triggers as much as possible. A journal or smartphone application may assist with this. She needs to track seasonal symptoms and symptoms related to temperature, humidity, dust, animal dander, pollen, perfume, and so on.
- Make certain she has a written plan to treat exacerbations and knows when to seek emergency assistance.

6. How will you describe mild persistent asthma to L.B.?

There are varying degrees of asthma. Individuals with mild persistent asthma typically have symptoms that occur more than twice a week but less than once a day. Nighttime symptoms occur more frequently than twice a month. L.B. may experience exacerbations that might affect activity, but her normal physical activity should not be affected.

7. The provider orders triamcinolone (Azmacort) two puffs bid and albuterol (Ventolin) two puffs every 6 hours as needed. What points will you include when teaching L.B. about these 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<sub>2</sub> 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. You would review the proper use of the MDI.

8. L.B. asks, “Why do I have to use this inhaler? Can't I just take some pills?” Your response to L.B. is based on the knowledge that the inhalation route is:

- a. Safer and more effective than pills
- b. Less expensive than combination therapy
- c. Easier to master than oral therapy
- d. More likely to assist in curing her asthma

Answer: a

Because the inhalation 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 not curative but used only to control symptoms.

9. The provider gives L.B. a prescription for a peak flow meter (PFM). What is a PFM? Give L.B. precise instructions to perform the PFM maneuver.

A 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.” Record the reading. Repeat two times for a total of three measurements. Remember that the PFM reading is effort dependent and it is important for the readings to be within 5% of one another. If one reading is much smaller than the other two, it should be discarded and another reading taken.

A decreased peak expiratory flow rate (PEFR) indicates airway obstruction. The maneuver requires a consistent maximal effort on the part of the individual being tested.

## PART 1 MEDICAL-SURGICAL CASES

10. L.B. asks why she has to use the PFM. Explain the purpose of the peak expiratory flow rate (PEFR) measurement, what an asthma action plan is, and the role the PEFR plays in an asthma action plan.

The PEFR, measured in liters per minute, indicates airflow and is used to detect the presence of any 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 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 "okay" and may continue with daily activities. It is important that each patient have a care plan to address what to do if the readings fall in the yellow or red zone. Readings in the yellow zone indicate the patient is having a moderate asthma attack and should follow the plan for increasing airflow rate. Readings in the red zone indicate the patient is having a severe asthma attack and should seek immediate medical assistance.

11. You set up an asthma action plan for L.B. What will you teach L.B. to do if her PEFR value falls into the yellow or red zone?

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 use of a beta<sub>2</sub>-adrenergic agonist inhaler more frequently, might be needed to increase airflow.

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<sub>2</sub>-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.

12. You instruct L.B. in the proper use of a 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.
- 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, hold your breath for 10 seconds, then exhale.
- Wait 1 minute between puffs.

13. 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:  $200/4 (2 \times 2) = 50$  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:

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

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



14. As you are concluding your session, L.B. looks at you and says, “This is absolutely, utterly overwhelming.” What should you tell her to reassure her?  
 Acknowledge that it is normal to feel overwhelmed and fearful and assure her that the health care team will be there to help her. Validate that the feelings she is having now will evolve and she will get to a point where she will find her situation manageable. To improve her self-confidence, reassure her that she has the education and resources to control her asthma and that she will feel much better than she does now. Encourage her to use ways of coping that she has used in the past in stressful situations and to talk with people in her social network. Link her with community resources, such as a support group, and make sure she has the appropriate contact information should she have questions after she leaves.
15. You would recognize the need for additional teaching if L.B. says which of the following? Select all that apply.
- "I will use the albuterol inhaler 30 minutes before exercising."
  - "My husband needs to know what to do in case I have an attack."
  - "If the reading is in the yellow zone, I need to use rescue drugs and seek help immediately."
  - "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."

Answers: a, c, f

The treatment of asthma is aimed at avoiding known allergens and respiratory irritants and controlling symptoms and airway inflammation. Beta<sub>2</sub>-adrenergic agonists are most successful at maintaining bronchodilation during exercise when they are inhaled 10 to 20 minutes before exercise. If the PEFR is in the red zone, not the yellow, it indicates a serious problem and action must be taken. 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

At the next follow-up visit, L.B.'s peak flow on the albuterol (Ventolin) and triamcinolone (Azmacort) has increased to 450 L/min, which is 88% of the predicted; her cough has subsided, and she has been running without any problems. There have been no nighttime awakenings, no loss of work, and no emergency department visits. She can demonstrate appropriate inhaler technique and has her completed peak flow diary on her smartphone.





## Case Study 23 Community-Acquired Pneumonia

**Difficulty:** Intermediate

**Setting:** Hospital

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

**Giddens Concepts:** Coping, Gas Exchange, Infection, Oxygenation, Patient Education, Safety

**HESI Concepts:** Assessment, Gas Exchange, Infection, Nursing Interventions, Oxygenation, Patient Education, Safety, Stress & Coping

### ► Scenario

C.K.'s sister has brought her 71-year-old brother to the primary care clinic; he came down with a fever 2 days ago. She says he has shaking chills and a productive cough and he cannot 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 at 1130. The intern is busy and asks you to complete your routine admission assessment and call her with your findings.

1. Identify four priority areas to include in your assessment.
  - Obtain complete vital signs (VS) with  $SpO_2$  on room air.
  - Physical assessment, focusing on cardiovascular and pulmonary components and determination of mental status.
  - Ask about current medication use and previous medical history.
  - Question the patient about his presenting symptoms.
  - Determine a previous history of pneumonia, pneumococcal polyvalent vaccine (Pneumovax), yearly flu vaccine.

### CASE STUDY PROGRESS

Your assessment findings are as follows: CK's vital signs (VS) are 154/82, 105, 32, 103° F (39.4° C),  $SpO_2$  84% on room air. You auscultate decreased breath sounds and coarse crackles in the left lower lobe anteriorly and posteriorly. 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. He is a lifetime nonsmoker. Past medical history includes coronary artery disease and myocardial infarction with a stent. He is currently on metoprolol (Lopressor), amlodipine (Norvasc), lisinopril (Zestril), and furosemide (Lasix); for his type 2 diabetes mellitus, he is taking metformin (Glucophage) and glipizide (Glucotrol). 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 does not remember the name of the antibiotic.

2. Which of these assessment findings are significant? State your rationale.
  - C.K.'s pulse, respirations, and temperature are elevated;  $SpO_2$  indicates hypoxemia if hemoglobin (Hgb) and hematocrit (Hct) are normal.
  - Decreased breath sounds and crackles in the left lower lobe 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 (coronary artery disease, myocardial infarction, and diabetes mellitus) increases his mortality risk.

## PART 1 MEDICAL-SURGICAL CASES

## Chart View

## Physician's Orders

2100-Calorie diabetic diet  
 VS q2h  
 IV of D5 ½ NS at 125 mL/hr  
 Ceftriaxone (Rocephin) 1 g IV every 12 hours  
 Metaproterenol sulfate (Alupent) 0.4% nebulizer treatment q3h  
 Titrate O<sub>2</sub> to maintain SpO<sub>2</sub> over 90%  
 Obtain sputum for C&S  
 STAT Blood cultures & sensitivity  
 CBC with differential and basic metabolic panel  
 Chest x-ray (CXR) now and in the morning  
 Continue home medications

3. You obtain orders from the physician. Outline a plan of what you need to do in the next 2 to 3 hours.  
**Start O<sub>2</sub>, obtain the STAT blood cultures, administer the Alupent treatment, and order STAT CXR. Attempt to obtain a sputum specimen before beginning the antibiotic. Start an intravenous (IV) line and initiate the IV fluids. Obtain the admission blood work. Repeat VS and assessment as needed. Reconcile home medications.**
4. Is the IV fluid 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 O<sub>2</sub> to maintain SpO<sub>2</sub> over 90%?  
**The order means that you are to titrate the O<sub>2</sub> flow rate to maintain the saturation reading on C.K.'s oximeter (SpO<sub>2</sub>) above 90%. According to the oxyhemoglobin dissociation curve, a hemoglobin saturation of 90% (SpO<sub>2</sub> of 90%) means that the partial pressure of O<sub>2</sub> in the arterial blood (Pao<sub>2</sub>) is approximately 60 mm Hg (remember that normal Pao<sub>2</sub> 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 hemoglobin saturation reflect larger decreases in Pao<sub>2</sub> (e.g., SpO<sub>2</sub> of 85% reflects a Pao<sub>2</sub> of 50 mm Hg; SpO<sub>2</sub> of 80% means the Pao<sub>2</sub> is 44 mm Hg).**
6. What is a C&S test, and what role will blood and sputum cultures play in C.K.'s care?  
**The term C&S means "culture and sensitivity." A culture is a growth of an organism in a nutrient medium to specifically identify the microbe. After the microbe has been isolated, its susceptibility to specific antibiotics or the 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. What would you expect the CXR results to reveal?
  - In a patient with pneumonia, you would expect the CXR image to reveal patchy areas of consolidation in the area that is affected.
  - Other findings from the CXR examination would include size and fluid accumulation (in lungs, pleural space, or around heart), congestion in large blood vessels of the chest, and the presence and position of any tubes and catheters.

8. You need to follow a specific protocol when obtaining peripheral blood cultures. Place in order the steps you will perform.

- \_\_\_\_\_ 1. Select venipuncture site. Cleanse and allow to dry.
- \_\_\_\_\_ 2. Inject 10 mL of blood into the aerobic bottle.
- \_\_\_\_\_ 3. Perform venipuncture and collect 20 mL of venous blood.
- \_\_\_\_\_ 4. Verify patient's identity and perform hand hygiene.
- \_\_\_\_\_ 5. Attach identification to specimens and send to laboratory within 30 minutes.
- \_\_\_\_\_ 6. Inject 10 mL of blood into the anaerobic bottle.

Answer: 4, 1, 3, 6, 2, 5

9. 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

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

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



10. How will you ensure that the home medication list is accurate?

For a newly hospitalized patient, there are four steps to ensuring a home medication list is accurate. First, obtain and verify the patient's medication history. Review with C.K. all the medication he is taking, including the name, dosage, frequency, and route. Once a list is compiled, validate with C.K. that the list is current and complete. Second, document the medication list in the patient's record. Place C.K.'s home medication list in a highly visible area in the record so that all members of the health care team have ready access. Third, ensure that orders are written for the hospital medication regimen. This would be done by the health care team member designated by the facility. Finally, create a medication administration record for C.K. according to facility policy.

### CASE STUDY PROGRESS

The next morning you are again assigned to care for C.K. Your assessment findings are as follows: VS 154/82, 92, 26, 100° F (37.8° C), SpO<sub>2</sub> 94% on 2 L oxygen per nasal cannula. He appears to be in no apparent distress and denies any dyspnea. You auscultate decreased breath sounds and coarse crackles in the left lower lobe anteriorly. His skin is pale, warm, and dry. He has a cough productive of yellow-colored sputum and complains of pain in the left side of his chest when he coughs.

11. Is C.K. recovering as expected? Defend your response.

C.K. is beginning to respond to therapy but still has symptomatic CAP as evidenced by his lung sounds, elevated temperature, elevated respiratory rate, and need for oxygen therapy to maintain the SpO<sub>2</sub> of 94%. The sputum is no longer rust-colored; yellow sputum can be expected for several weeks after an episode of CAP.

12. Based on your evaluation of C.K., write an outcome to achieve by the end of your shift, then list six priority interventions you will perform toward achieving this goal.

Outcomes will vary and may include: Absence of crackles; SpO<sub>2</sub> 98% on 2 L oxygen per nasal cannula or a SpO<sub>2</sub> 94% on room air; normal air flow on auscultation; or being afebrile.

- Continue to monitor VS and pulse oximetry readings every 2 to 4 hours.
- Auscultate lung sounds and assess mental status every 2 to 4 hours.
- Administer oxygen as prescribed, titrating to maintain SpO<sub>2</sub> over 90%.
- Perform coughing and deep breathing exercises every 2 hours.
- Ambulate C.K. as tolerated.
- Maximize fluid intake by maintaining ordered IV therapy and promoting oral fluids as tolerated.

## PART 1 MEDICAL-SURGICAL CASES

- Administer antibiotics as prescribed.
- Administer respiratory treatments as prescribed.

13. By the end of your shift, which of the following assessment findings would best indicate that C.K. is responding to therapy?
- Cough productive of yellow sputum; lung sounds clear; Spo<sub>2</sub> 96% on room air
  - Complaints of dyspnea; respiratory rate of 26 on 2 L oxygen; clear lung sounds
  - Coarse crackles in posterior lower lobes; respiratory rate 22; no complaints of chills
  - Cough productive of white sputum; temperature 100.0° F (37.8° C); Spo<sub>2</sub> 98% on 2 L oxygen

Answer: a

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 Spo<sub>2</sub> 96% on room air is satisfactory. Although clearing of sputum is preferable, a cough productive of yellow sputum could be expected for several weeks after an episode of CAP.

## CASE STUDY PROGRESS

After continuing the plan of care for 2 more days, C.K. recovers from his pneumonia and is preparing for discharge.

14. You know that C.K. is at increased risk for contracting another CAP infection. Describe four strategies for preventing CAP infections you will include in C.K.'s discharge teaching plan.
- Stress the importance of immunization with pneumococcal vaccine with a booster in 6 years.
  - Stress the importance of obtaining a yearly influenza vaccine.
  - Stress the importance of avoiding exposure to people with colds or flu and crowds during flu season.
  - Teach good hand washing technique.
  - Teach how to handle and properly dispose of secretions.
  - Teach the importance of oral fluids to thin pulmonary secretions and facilitate expectoration.
15. 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. 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. How does he get his meals? How does he do his shopping and his laundry? Make certain his concern is addressed in at least one concrete arrangement before he leaves the hospital.
16. What are some community resources from which C.K. may benefit?  
The local senior center and area agency on aging are great resources, often organizing classes, outings, volunteer opportunities, and social functions for people who want to be with other seniors. Churches, health clubs, civic and service organizations, educational classes, travel clubs, and special interest groups are good places to be with people of all ages.



## 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

**Giddens Concepts:** Coping, Gas Exchange, Oxygenation, Patient Education, Safety

**HESI Concepts:** Assessment, Gas Exchange, Nursing Interventions, Oxygenation, Patient Education, Safety, Stress & Coping

### ► Scenario

A.B., a 68-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 38 and labored and shallow, 102.1° F (38.9° C), and SpO<sub>2</sub> 85% on room air. Chest x-ray examination reveals a large pleural effusion and pulmonary infiltrates in the right lower lobe consistent with pneumonia.

1. 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 O<sub>2</sub> and nutrients to the cells. Because of this, A.B.'s systolic blood pressure (SBP) is slightly elevated, and he is tachycardic and tachypneic with shallow, labored breathing. His temperature is elevated because of an inflammatory response related to the pulmonary infection and increased work of breathing. Hypoxemia will cause anxiety, increased heart rate, and dyspnea.**

2. How does the underlying pathophysiology relate to A.B.'s presenting signs and symptoms?

**Pleural effusion is an accumulation of either transudative (serous) or exudative (purulent material) fluid within the pleural space (between visceral and parietal pleura).**

**The inflammation of the pleura alters capillary membrane permeability and impairs lymphatic drainage, resulting in excess pleural fluid accumulating in the pleural space. 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 ventilation/perfusion ( $\dot{V}/\dot{Q}$ ) mismatch and the resulting symptoms (respirations 38; shallow, labored breathing; weakness; dyspnea) of hypoxemia. His chest pain is caused by pleural irritation (pleuritic pain); the pleura are full of pain sensors. A dry, irritating cough is most likely a result of pleural inflammation.**

### 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 intravenously (IV) every 8 hours.

3. What is a thoracentesis?

**It is the removal of fluid from the pleural space with 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.**

4. 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 drops per minute will you regulate the infusion?

**66.6 or 67 gtt/min (20 gtt × 100 mL/30 min)**

## PART 1 MEDICAL-SURGICAL CASES

5. What interventions will you implement to promote A.B.'s clearing pulmonary secretions?
- Coughing and deep breathing facilitate expectoration of secretions, promote lung expansion, and prevent atelectasis.
  - Use of an incentive spirometer promotes lung expansion and provides visual feedback for A.B. 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.
  - Promoting IV and oral fluid intake will maximize A.B.'s hydration status.

## CASE STUDY PROGRESS

The pleural C&S results indicate a large amount of *Klebsiella* organism growth that is not sensitive to cefuroxime (Ceftin).



6. 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.
7. 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 regarding this procedure?
- Provide adequate analgesia.
  - Obtain a thoracotomy tray, various sizes of chest tubes (28 Fr and 32 Fr), 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.
8. What interventions will you implement afterward to maintain A.B.'s chest tube system?
- Auscultate A.B.'s lungs sounds every 2 to 4 hours.
  - Assess placement and site of chest tube every 2 to 4 hours.
  - Observe and record amount, rate, and type of drainage at least each shift.
  - Observe water seal fluctuations and fluid level every 2 hours.
  - Evaluate any air leaks in system every 2 to 4 hours.
  - Observe for fluid level and bubbling in suction control chamber every 2 to 4 hours.
9. Evaluate each of the following statements about chest tube drainage systems. Enter *T* for true or *F* for false. State why false statements are incorrect.
- \_\_\_\_ 1. The height of the water in the suction control mechanism limits the amount of suction transmitted to the pleural cavity.
  - \_\_\_\_ 2. A suction pressure of +20 cm H<sub>2</sub>O is usually 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. Because the chamber is a closed system, water cannot evaporate from the system.



- \_\_\_\_\_ 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 collection chamber is full, so you need to connect a new drainage system to the chest tube. It is fine to momentarily clamp the chest tube while you disconnect the old system and reconnect the new.

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

Corrections to false statements:

- 2. Suction pressure is negative;  $-20$  cm  $H_2O$  is common.
- 5. The chest drainage system is not a closed system, and  $H_2O$  evaporates over time. Observe the  $H_2O$  level and add sterile  $H_2O$  or NaCl using a sterile catheter tip syringe as needed.
- 6. This procedure, called *chest tube stripping*, is dangerous and should be avoided. Chest tube stripping can generate up to 400 cm water pressure, causing pieces of lung tissue to be sucked through the holes of the chest tube.
- 7. If the drainage unit cracks or breaks, insert the chest tube into a bottle of sterile water 2 cm below the level of the water to prevent air from entering the pleural space and call for help; the assistant will need to set up a new drainage device.

### CASE STUDY PROGRESS

The next day you are again assigned to care for A.B. At the beginning of the shift, you assess A.B. and find that his condition is stable. His lung sounds remain diminished in the right lower lobe and his  $SpO_2$  is 95% on oxygen at 2 L per nasal cannula. The chest drainage system is attached to suction at 20 mm Hg; there is still an air leak present. His morning chest x-ray examination showed some residual pleural effusion. Four hours into your shift, he pages you through the call system and tells you he feels “short of breath.” You immediately go to his room. A.B. is sitting in the chair.

- 10. Describe the priority assessment you must perform at this time.  
You need to assess the patency of the chest drainage system; take vital signs; auscultate lung sounds; measure oxygen saturation; assess for signs of respiratory distress, including labored respirations and his level of dyspnea; and determine if he is experiencing other symptoms, such as chest pain. Palpate around the insertion site for subcutaneous emphysema.
- 11. You determine that the chest tube has become disconnected from the drainage system and is contaminated. What do you need to do?  
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 until a new chest drainage unit is set up. This establishes a water seal, allows the escape of air, and prevents the reentry of air. You would stay with the patient while another staff member sets up the new system. Notify the physician of the event.
- 12. After the chest drainage system has been reestablished, A.B.'s complaints of dyspnea resolve and you need to document what happened. Write an example of a documentation entry describing this event.  
Answers will vary but should include the time, a description of A.B.'s complaints, the assessment findings, the actions taken by the nurse, including reestablishing a new drainage system, and the patient's response after the chest drainage system has been reestablished.

## PART 1 MEDICAL-SURGICAL CASES

## CASE STUDY PROGRESS

The remainder of A.B.'s admission is uneventful. After 6 days of aggressive antibiotic and pulmonary therapy, the chest tube is discontinued and A.B. is ready to be discharged.

13. 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:** Emergency department, hospital

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

**Giddens Concepts:** Collaboration, Coping, Gas Exchange, Oxygenation, Patient Education, Safety

**HESI Concepts:** Assessment, Collaboration/Managing Care, Gas Exchange, Nursing Interventions, Oxygenation, Patient Education, Safety

### ► Scenario

A.W., a 72-year-old woman with 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, started on intravenous lactated Ringer's at KVO (keep vein open), and transported to the nearest emergency department (ED).

On A.W.'s 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) examination shows an 80% pneumothorax on the right.

### Chart View

#### Arterial Blood Gases (ABGs; 100% O<sub>2</sub>)

pH	7.25
Paco <sub>2</sub>	92 mm Hg
Pao <sub>2</sub>	32 mm Hg
HCO <sub>3</sub>	27 mmol/L
Spo <sub>2</sub>	53%

1. 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.**

2. Interpret A.W.'s ABGs.

**Significant respiratory acidosis with profound hypoxemia. Without immediate resuscitation, A.W. is near death.**

3. What is the reason for A.W.'s ABG results?

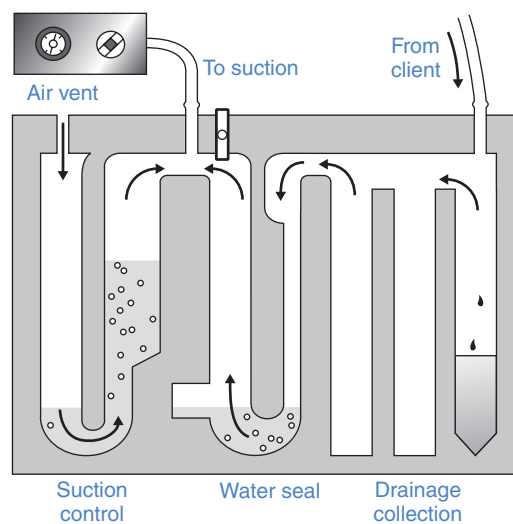
**Eighty percent of her right lung is collapsed and not taking part in gas exchange. Her left lung, great vessels, and heart are compressed also.**

## PART 1 MEDICAL-SURGICAL CASES

4. 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 28 Fr and 32 Fr chest tubes, and prepare a thoracotomy tray for a thoracostomy (chest tube insertion).
  - 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.
  
5. 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 blood pressure (BP) and respiratory effort.
  
6. The ED physician inserts a size 32 Fr 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, inspired air will continue to escape into the pleural space and into the chest tube drainage system until the hole heals.
  
7. 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 inflate completely.
  
8. Part of your responsibilities after the chest tube has been 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 needs to note the presence or absence of an air leak every 8 hours and the amount of suction being delivered. Mark the level of drainage on chest drainage system columns a minimum of every 8 hours and record the 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. While A.W. has a chest drainage system, 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 A.W. has already been taught, the NAP can encourage A.W. to cough, deep breathe, and use the incentive spirometer.

11. The secretary tells you A.W.'s husband has just arrived. What will you discuss with him about A.W.'s status and her hospital admission?

- Look for him in the 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 look 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 will continue to happen. How will you respond?

If A.W. continues to experience spontaneous pneumothoraxes 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.

-  13. It is now the end of your shift and A.W.'s condition has stabilized. Using the SBAR framework, describe the bedside change-of-shift report you will give the oncoming nurse. You will begin with introducing the oncoming nurse. Then, relate A.W.'s name, age, physician, code status, allergies, and admitting diagnosis. Because she is a new admission, review the brief history behind her hospitalization. Describe her condition, including your assessment, laboratory data, and diagnostic test results. Review the status of the chest drainage system and describe other treatments administered and how she responded. State any specific interventions you implemented that were specific to her. Ask A.W. and her husband if they have any questions and have them describe any concerns they may have. Conclude with any treatment recommendations for the next shift, pending tests, and nursing concerns.

## PART 1 MEDICAL-SURGICAL CASES

## CASE STUDY PROGRESS

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

14. 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.

## CASE STUDY PROGRESS

A.W. recovers uneventfully and is discharged 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.

15. 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.

16. 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 a water-tight dressing around the chest tube site."
  - "I can shower if the device is completely covered in plastic."
  - "When I am moving around I must keep the collection system 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 ambulate safely with a mobile chest tube drainage system, the patient must keep the collection system below the level of the insertion site and all connections 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 #1

**Difficulty:** Intermediate

**Setting:** Intensive care unit

**Index Words:** mechanical ventilation, endotracheal tube (ETT), assessment, acute respiratory failure (ARF), arterial blood gases (ABGs)

**Giddens Concepts:** Clinical Judgment, Collaboration, Gas Exchange, Oxygenation, Safety

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Collaboration/Managing Care, Gas Exchange, Nursing Interventions, Oxygenation, Safety

### ► Scenario

P.R., a 66-year-old woman who has no history of respiratory disease, is being admitted to your intensive care unit (ICU) from the emergency department (ED) with a diagnosis of pneumonia and acute respiratory failure (ARF). The ED nurse tells you that P.R. was stuporous and cyanotic on her arrival to the ED. Her initial vital signs were 90/68, 134, 38, 101° F (38.3° C) with an  $\text{Spo}_2$  of 53%. She was endotracheally intubated orally and placed on mechanical ventilation and has equal breath sounds. Her ventilator settings are synchronized intermittent mandatory ventilation of 12/min, tidal volume ( $V_T$ ) 700 mL,  $\text{FiO}_2$  0.50, positive end-expiratory pressure (PEEP) 5 cm  $\text{H}_2\text{O}$ . The nurse tells you P.R. had an initial chest x-ray (CXR) examination that confirmed the diagnosis of pneumonia, but she needs an additional CXR examination stat.

#### 1. Describe the pathophysiology of ARF.

ARF is the inability of the body to sustain the respiratory drive, resulting in a decreased capacity to exchange oxygen and  $\text{CO}_2$ . ARF can be a result of either a failure to oxygenate or a failure to ventilate or a combination of both. Type I or hypoxemic ARF is defined as the inability to maintain a  $\text{PaO}_2$  greater than 60 mm Hg with the patient 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 after various lung removal surgeries. Type II ARF or the failure to ventilate results from disease processes that interfere with a patient's ability to effectively remove  $\text{CO}_2$ . Type II ARF is characterized by a  $\text{PaCO}_2$  greater than 60 mm Hg or a pH less than 7.35. It is associated with chronic obstructive pulmonary disease (COPD), restrictive pulmonary diseases (obesity, pneumothorax), neuromuscular defects (Guillain-Barré syndrome, multiple sclerosis, intentional overdose, and spinal cord injury), central nervous system dysfunction (stroke, meningitis, and increased intracranial pressure, and chest trauma).

#### 2. How does the underlying pathophysiology relate to P.R.'s presenting signs and symptoms?

P.R. was showing signs of hypoxemia related to the underlying infection and resulting ARF, including altered level of consciousness and cyanosis. The presence of the fever is related to the underlying pulmonary infection. Tachycardia and tachypnea are related to the presence of the fever and hypoxia.

#### 3. Describe each of P.R.'s ventilator settings and the rationale for the selection of each.

Ventilator settings depend 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  $V_T$ . Between these breaths, the patient can spontaneously breathe at his or her own rate and  $V_T$ . 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 mode.

## PART 1 MEDICAL-SURGICAL CASES

- 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  $F_{iO_2}$  may be reduced to the lowest possible level to maintain gas exchange and to prevent oxygen toxicity.
- $F_{iO_2}$  or fraction of inspired oxygen is the concentration of oxygen being delivered to the patient.
- 12/min is the number of ventilations delivered each minute. The initial rate with synchronized intermittent mandatory ventilation is usually set at 10 to 14 /min.



4. Why does P.R. need a second CXR examination?  
The second CXR examination is needed to confirm the placement of the endotracheal tube (ETT).

## Chart View

## Arterial Blood Gases (ABGs)

pH	7.28
$P_{aCO_2}$	62 mm Hg
$HCO_3^-$	26 mmol/L
$P_{aO_2}$	48 mm Hg
$SpO_2$	53%

5. The ABG results from the sample drawn in the ED before intubation are sent to you. Interpret P.R.'s ABG results.  
P.R.'s pH indicates that she is acidotic. Her  $P_{aCO_2}$  level is high, which indicates that she is retaining carbon dioxide, which is consistent with ARF. Her bicarbonate level is within normal limits. A  $P_{aO_2}$  of 55 mm Hg indicates hypoxemia related to respiratory failure. These are consistent with respiratory failure, which is described as a  $P_{aO_2}$  of 60 mm Hg or lower and a  $P_{aCO_2}$  of 50 mm Hg or higher in a patient with no history of respiratory disease.
6. List eight collaborative care interventions that would be implemented for P.R. and the rationale for each.
- Blood cultures and sensitivity and 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 ABG sample.
  - Nasogastric tube to low intermittent suction to drain stomach contents, lowering risk of aspiration.
  - Foley catheter to down drain to assist in closely monitoring P.R.'s fluid status.
  - Deep vein thrombosis 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 gastrointestinal bleeding.
7. What is your priority nursing goal at this time?  
The nursing priority right now is to improve her respiratory status.



8. Describe six interventions you will perform over the next two hour based on this priority.
- Obtain ordered blood and sputum cultures; then initiate antibiotic therapy.
  - Elevate the head of her bed 30 degrees.
  - Provide suctioning as needed.
  - Administer respiratory medications and medications for sedation if the time interval is appropriate.
  - Place her on an electrocardiogram (ECG) monitor and continuous pulse oximetry. Monitor her vital signs as needed.
  - Maintain IV therapy.
  - Monitor ABG results.
  - Monitor for signs of deterioration.
9. P.R. is not heavily sedated and seems anxious about all that is going on. Describe how you can help her.
- Orient her to the ICU surroundings, routines, equipment, and noises. Explain that alarms may periodically sound, which may be normal, and that you and the other staff will be in close proximity. Explain the need for your frequent assessments and suctioning, being mindful to reinforce the explanation of all procedures before performing them. If her inability to speak is an issue, establish another means of communication, such as word cards, writing pad and pencil, or picture board. Determine if she would like a visit by the psychiatric clinical nurse specialist, psychiatrist, or hospital chaplain, as appropriate.

### Chart View

#### Arterial Blood Gases

pH	7.30
Paco <sub>2</sub>	52 mm Hg
HCO <sub>3</sub>	22 mmol/L
Pao <sub>2</sub>	70 mm Hg
SpO <sub>2</sub>	88%

10. ABGs are redrawn after P.R. has been on mechanical ventilation for 2 hours. What ventilator setting changes do you anticipate based on your interpretation of these values? Select all that apply, and explain your rationale.
- a. Increasing the PEEP to 10 cm
  - b. Increasing the rate on the ventilator to 16/min
  - c. Increasing the V<sub>T</sub> to 850 mL
  - d. Changing to continuous mandatory ventilation

Answers: a, b

Because P.R.'s pH and Paco<sub>2</sub> indicate she is retaining carbon dioxide, you would anticipate raising the respiratory rate so that the lungs can eliminate more 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 Pao<sub>2</sub> levels.

Raising the V<sub>T</sub> will increase the chance for complications such as pneumothorax. Because the continuous mandatory ventilation mode is used for patients with no control of respirations, such as those who are unconscious or paralyzed, it is not appropriate for P.R.

## PART 1 MEDICAL-SURGICAL CASES

11. Evaluate each of the following statements about caring for P.R. or a similar patient receiving mechanical ventilation with an endotracheal tube (ETT). Enter *T* for true or *F* for false.

Discuss why the false statements are incorrect.

- \_\_\_ 1. Administer muscle-paralyzing agents to keep P.R. 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 experienced nursing assistive personnel (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:

- 1. 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.
- 5. 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.
- 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 patient's condition.
- 10. Current recommendations from the Centers for Disease Control and Prevention (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.

12. You hear the high pressure alarm sounding on the mechanical ventilator and see that P.R.'s  $\text{Sao}_2$  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."

-  13. You determine that P.R. needs to be suctioned. Place in order the steps for safely performing in-line or closed suctioning.


- \_\_\_ 1. Hyperoxygenate patient.
- \_\_\_ 2. Use 5 to 10 mL of saline to rinse the catheter clear of secretions.
- \_\_\_ 3. Insert catheter until resistance is met or patient coughs.
- \_\_\_ 4. Assess patient's status and document procedure.
- \_\_\_ 5. Put on clean gloves and face shield; attach suction.
- \_\_\_ 6. Apply suction as you withdraw the catheter, not exceeding 10 seconds.
- \_\_\_ 7. Reassess patient status and suction again as needed.

Answer: 5, 1, 3, 6, 7, 2, 4


**CASE STUDY PROGRESS**

As P.R.'s primary nurse, you are responsible for her nursing care plan. Although the primary concern is her respiratory status, you are concerned about hydration, nutrition, oral hygiene, and skin integrity and decide to address each of these areas in P.R.'s plan of care.

14. Discuss five indicators you can use to assess her fluid status.
  - Vital signs (blood pressure, pulse)
  - 24-Hour intake and output (I&O) trends
  - Moisture of mucous membranes
  - Skin turgor
  - Daily weight and body weight over time
  - Urine specific gravity
  - Laboratory values
  
15. Write a nutrition-related outcome for P.R.
 

Answers will widely vary. 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.
  
16. Describe five interventions that could 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 consultation as needed.
  - Weigh P.R. daily and monitor for weight changes.
  - Monitor I&O.
  - If P.R. cannot tolerate enteral feeding, consider total parenteral nutrition (TPN).
  - Assess bowel function every 2 to 4 hours.
  - Monitor laboratory results as available.
  
-  17. The goals for P.R.'s mouth care are to preserve the oral mucosa and dentition and prevent P.R. from developing a secondary ventilator-assisted pneumonia. Identify three strategies for providing oral hygiene with an ETT in place.
  - Provide oral care with chlorhexidine once daily.
  - Brush her teeth twice daily. Use a soft pediatric-size toothbrush to prevent tissue damage.
  - Perform mouth care with oral moisturizers every 2 to 4 hours while she is awake and every 6 hours at night.
  - 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.
  
18. Identify three treatment goals related to skin and positioning.
  - Relieve pressure on the skin.
  - Improve pulmonary ventilation.
  - Enhance comfort.
  - Prevent contractures such as footdrop.

**PART 1 MEDICAL-SURGICAL CASES**

-  19. You plan to assess P.R.'s skin every 4 hours. What are four other strategies that 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.
  - Keep pressure off elbows and heels to prevent skin breakdown.
  - Use moon boots or high-top shoes to prevent footdrop.
  - Evaluate the appropriateness of an overlay air mattress or replacement of the regular mattress with an air mattress.



## Case Study 27 Mechanically Ventilated Patient #2

**Difficulty:** Advanced

**Setting:** Extended care facility

**Index Words:** Guillain-Barré syndrome (GBS), sedation, tracheostomy care, mechanical ventilation, symptom management, crisis management, *Clostridium difficile* infection

**Giddens Concepts:** Clinical Judgment, Collaboration, Gas Exchange, Infection, Oxygenation, Patient Education, Safety

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Collaboration/Managing Care, Gas Exchange, Infection, Nursing Interventions, Oxygenation, Patient Education, Safety

### ► 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 2 weeks and has shown no signs of improvement in respiratory muscle strength. Her ventilator settings are assist-control (A/C) of 12/min, tidal volume ( $V_T$ ) 700 mL,  $F_{iO_2}$  0.50, and positive end-expiratory pressure (PEEP) 5 cm  $H_2O$ . She is receiving enteral nutrition with Ensure Plus by PEG (percutaneous endoscopic gastrostomy [with a transjejunal limb]) tube (2800 kcal/24 hr). The NAP (nursing assistive personnel) reports that P.W.'s morning vital signs are 108/64, 118, 12, 100.6° F (38.1° C) and that P.W. may have diarrhea.

- Do any of P.W.'s vital signs concern you and why?  
P.W. has a fever with accompanying tachycardia that could signal that she is developing atelectasis or an infection such as pneumonia, a urinary tract infection (UTI), or line-related sepsis.
- Why is P.W.'s respiratory rate 12 breaths per minute?  
P.W.'s ventilator is on A/C mode because she must not have enough innervation to her respiratory muscles to trigger the ventilator to deliver a breath, so the machine is doing all the work and her respirations are the preset rate.
- What are common causes of enteral nutrition diarrhea?  
Diarrhea may result from a variety of causes including bacterial or viral infection, use of a hyperosmolar formula, lactose intolerance, fecal impaction, gut atrophy, and drug therapy effects, including the use of antibiotics, magnesium-containing antacids, and inert drug fillers, including magnesium stearate, docusate sodium, and sorbitol.
- Describe the assessment you need to perform at this time.  
First, you need to assess P.W. for the cause of the fever. Auscultate P.W.'s lung sounds, measure pulse oximetry, and assess her skin color and moisture, sputum color, and characteristics of her urine. Assess her PEG sites and any IV sites. Second, determine if she does have diarrhea. Evaluate her intake and output records, current weight, and weight trends since she became ill. Assess for any abdominal pain, auscultate bowel sounds, and palpate for any tenderness. Then, if you conclude that she does have diarrhea, determine if she has any signs of fluid and electrolyte imbalance, review her latest laboratory values; assess for any signs of dehydration; and assess her skin for any signs of breakdown.

## PART 1 MEDICAL-SURGICAL CASES

5. While you are assessing P.W., she has an explosive, watery stool. Because her other assessment findings are unremarkable, you believe a gastrointestinal infection, possibly *Clostridium difficile*, is responsible for the onset of the fever and the diarrhea. Based on this premise, what actions do you need to take?

Because the cause of diarrhea needs to be determined, you need to consult with the health care provider regarding collection of a stool sample for bacterial culture and sensitivity, ova and parasites, and *C. difficile* toxin. Until the cultures return, you need to place P.W. on contact precautions and place signage reminding staff to use traditional hand washing instead of hand sanitizer. Do not administer any antidiarrheal drugs because if *C. difficile* toxin is present, the diarrhea helps to eliminate the toxin.

6. Because she had diarrhea, you decide to give P.W. a bath. You note that her cheeks are billowing slightly 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 endotracheal tube (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.

7. Describe how you can determine the cause of the problem.

You could try repositioning P.W., placing a stopcock in the inflation valve, auscultating the lungs, checking the length of the tube at the lip to see if the tube has moved, checking the cuff pressure, and evaluating the patency of the mechanical ventilation system.

## CASE STUDY PROGRESS


You believe that P.W. has developed an air leak, and you insert more air in the cuff to seal the leak. This temporarily corrects the problem, but over the next 24 hours, the leak returns and becomes worse, and the ventilator's low exhaled volume alarm begins to sound frequently.

8. What action will you take?

Notify the physician of the air leak. Because the ETT has been in place for 2 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.

9. 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. Tell them some advantages to the trach are that she will not have a tube in her mouth and she might be able to get off 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.

-  10. What are three evidence-based practices you will need to continue or implement to prevent ventilator-assisted pneumonia after she has the tracheostomy?
- Keep the head of the bed elevated 30 to 45 degrees.
  - Practice good hand washing before and after patient contact; wear a gown when contact with secretions is a possibility.
  - Use a closed suctioning system for removing tracheal secretions.
  - Provide oral care with chlorhexidine once daily. Brush her teeth twice daily. Use a soft pediatric-size toothbrush to prevent tissue damage. Perform mouth care with oral moisturizers every 2 to 4 hours while she is awake and every 6 hours at night.

### CASE STUDY PROGRESS

P.W. undergoes the tracheostomy procedure without complications. In the interim, the cultures come back confirming the presence of a *C. difficile* infection and she is started on antibiotic therapy. When you return the morning after the tracheostomy procedure 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. 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.

11. Discuss the significance of these assessment findings.
- If the trach tape was tied too tightly, the tracheostomy flange completely covers and compresses the stoma. This could have resulted in the leakage of air, or subcutaneous emphysema, into the surrounding subcutaneous tissues around the incision.
12. 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 does not 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.
  - 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.
  - Keep the head of P.W.'s bed 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.
13. P.W.'s husband arrives and you speak with him about her having developed subcutaneous emphysema. He collapses into the nearest chair, tears begin to roll down his cheeks, and he says, "It's been almost a month now, and all these things keep happening. Are you sure she'll recover?" How would you respond?
- Tell him that 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.

## PART 1 MEDICAL-SURGICAL CASES

14. P.W. has been receiving lorazepam (Ativan) 1 mg IV every 4 hours to reduce her anxiety. Given her current situation and her husband's distress, describe six nonpharmacologic options you could use to promote the well-being of P.W. and her husband.
- Help them develop a form of communication, such as a combination eye-blinking and movement system, and encourage them to communicate.
  - 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.
  - Reassure them that anxiety and other negative feelings are understandable and expected.
  - Use television, radio, or music for reorientation or diversion.
  - Use relaxation techniques, such as deep breathing and imagery.
  - Keep both of them informed about P.W.'s progress and changes in care.
  - Involve the chaplain, social worker, or psychologist with the couple as needed.

## CASE STUDY PROGRESS

Over the next several weeks, P.W. progressively regains neurologic functioning.

15. What factors would be considered in determining when 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 examination. 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.
16. What are your responsibilities during the weaning process?
- Most patients will be excited about coming off 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  $\text{SpO}_2$  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.
17. Which assessment finding during the weaning process would indicate P.W. should be placed back on the ventilator?
- a. Heart rate 92 beats/min
  - b. Temperature 99.3° F (37.4° C)
  - c. Respiratory rate 34 breaths/min
  - d.  $\text{SaO}_2$  of 94%
- Answer: c
- If P.W. displays tachypnea or other signs of intolerance, including dyspnea, tachycardia, dysrhythmias, an  $\text{SaO}_2$  less than 91%, hypertension or hypotension, agitation, diaphoresis, anxiety, and changes in the level of consciousness, the weaning process should be discontinued.





## Case Study 28 Emphysema

**Difficulty:** Intermediate

**Setting:** Home care

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

**Giddens Concepts:** Coping, Gas exchange, Health Promotion, Patient Education

**HESI Concepts:** Assessment, Gas Exchange, Health Promotion, Oxygenation, Patient Education, Stress & Coping

### ► Scenario

C.E., a 73-year-old married man and retired railroad engineer, visited 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  $SpO_2$  registered 83%. He was sent to the local hospital for a chest x-ray examination and arterial blood gases (ABGs) after resting 20 minutes on room air. C.E. returned to the office. After evaluating the results, the physician told C.E. he had severe emphysema and must start on continuous oxygen ( $O_2$ ) therapy at a 2 L flow rate. The physician completed a prescription for the oxygen therapy, including on the prescription C.E.’s pulse oximetry and ABG results.

1. What is the rationale for starting C.E. on oxygen at a 2 L flow rate?  
**High-flow oxygen is contraindicated in patients with chronic obstructive pulmonary disease (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.**
2. What 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, defined as a  $Pao_2$  level less than 55 mm Hg or an arterial oxygen saturation  $SpO_2$  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. Information that needs to be on a prescription for oxygen includes the diagnosis, the prescribed liter flow, the frequency of use in hours per day, and the number of months therapy is expected to be needed.**
3. Based on the most common cause of emphysema, what assessment regarding health behaviors is needed?  
**Because smoking accounts for 82% of emphysema, ask whether he smokes. If he answers affirmatively, ask what, how much, and how long he has smoked. Was he exposed to second-hand smoke?**

### CASE STUDY PROGRESS

C.E. affirmed he has been a half-pack-per-day smoker for 50 years. The physician counseled C.E. on smoking cessation and C.E. agreed to stop smoking. The physician told C.E. his office would have a home equipment company call him to arrange delivery of the oxygen equipment and educate him on its use. As a registered nurse (RN) working for the company, you are assigned to be C.E.’s case manager.

4. How would you prepare for the initial home visit?
  - **Call to make an appointment when both C.E. and his wife can be there. Confirm their home address and any specifics, such as where to park.**
  - **Review C.E.’s Medicare and insurance coverage to verify what is covered; Medicare has specific contracted arrangements, and these are constantly changing.**

## PART 1 MEDICAL-SURGICAL CASES

- Gather materials to leave with C.E. and his wife, including contact information, 24-hour emergency telephone numbers, and patient education materials about emphysema, smoking cessation, and the use of O<sub>2</sub>.
  - Pack the O<sub>2</sub> units, O<sub>2</sub> adaptors, 50 to 100 feet of O<sub>2</sub> tubing, several nasal cannulas (NCs), and a small in-line flow meter.
5. What would you address with C.E. and his wife at the first visit?
    - Using simple illustrations and patient education materials, show them what emphysema is and explain why C.E. needs O<sub>2</sub>.
    - Show them the O<sub>2</sub> equipment, and explain how to use it. Give a demonstration, and then have C.E. explain everything to you and have them both demonstrate how to use the equipment.
    - Review how to clean the filters and cannula and when to change equipment.
    - Discuss how to use O<sub>2</sub> safely, how to travel with O<sub>2</sub>, and when to seek medical treatment. Leave the patient education materials with them, and highlight the most important information.
    - Discuss with C.E. his smoking cessation efforts, and intervene as needed to support his cessation efforts.
    - Inform them that you will visit again to reinforce the information discussed during this visit.
    - Repeat instructions concerning the 24-hour emergency services available to them.
  6. What assessment do you need to do at each follow-up visit with C.E.?
 

At each visit, assess his oxygenation status to ensure that the equipment and supplies are working properly. Review how much oxygen C.E. is using and how often he uses it. Inspect the skin of the face and around the ear and nose for signs of redness or irritation and the nasal mucosa for any dryness.

## CASE STUDY PROGRESS

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."

7. What can you tell him that could help?
  - Pad the top and posterior side of the ears so the tubing does not 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<sub>2</sub> tubing to protect the ears. The tubing must be taped in place to prevent slipping.
  - Examine the "sores" for signs of infection, and advise C.E.'s 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<sub>2</sub> 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."
8. 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. What specific teaching do you need to reinforce with C.E. and his wife?
 

Remind C.E. that it is dangerous to use vapor rubs or petroleum-based products around O<sub>2</sub>. There is a false perception that O<sub>2</sub> is very flammable. O<sub>2</sub> 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. Teach him to use lanolin, a water-based aloe moisturizing gel, K-Y Jelly, or a saline nasal spray to keep his nasal passages moistened.

9. After you have finished, his wife seems upset and tells you that C.E. is still "smoking a couple of cigarettes" a day. How do you handle this situation?

Absolutely stress to C.E. that he needs to quit smoking if he is on oxygen therapy. Smoking can be deadly to him and those around him. In some instances, if C.E. continues to smoke, then he will no longer qualify for oxygen therapy. If C.E. is going to continue to smoke, remind him that he cannot smoke in the same room or within 10 feet of O<sub>2</sub> or any of the equipment. There must be working smoke detectors throughout the home, and C.E. and his wife should have a fire escape plan.

### CASE STUDY PROGRESS

At your next visit 2 weeks later, C.E. tells you that he has not smoked since your previous visit. He is upset, though, over an episode a week ago. He says he walked to the kitchen for a snack and became increasingly short of breath. Per your instructions, C.E. removed the nasal cannula (NC), tested the flow against his check, and felt no O<sub>2</sub> 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 O<sub>2</sub> 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 O<sub>2</sub> tubing. C.E. sat at the table for 20 minutes before he could walk back to the living room.

10. Why did C.E. assume the peculiar position at the countertop?

Leaning forward takes advantage of gravity; the bowels are pulled forward, thereby allowing more room for the diaphragm to expand. 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.

11. C.E.'s wife states that since the incident, C.E. "doesn't want her out of his sight." She asks you to "talk some sense into him." She further elaborates, saying that since then "All he does is sit 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 is all very hard on me." What will you do to help C.E. and his wife cope with his condition?

COPD patients often have trouble 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:

- Acknowledge C.E.'s feelings of fear and panic at suddenly being without O<sub>2</sub>. Work out a plan whereby C.E.'s wife will check on him periodically or he can call for help. Explore the possible benefits of a remote alarm system in which he wears the alarm button on a lanyard around the neck, so that help can be summoned quickly in the event of an emergency.
- Review with C.E. and his wife how to check his equipment on a daily basis.
- Practice pursed-lip breathing, abdominal breathing, and breathing relaxation exercises 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 so he can relax himself enough to stop the adrenalin flush and stop the resulting bronchodilation. He can practice these breathing techniques anytime and anywhere.
- Assess C.E.'s level of daily activity before he was placed on O<sub>2</sub>. He should be able to do everything he did before he was placed on O<sub>2</sub>. Find out what he can do now, and encourage him to accomplish those activities. Establish which activities C.E. is experiencing particular difficulty performing, and review ways that these tasks can be performed in oxygen-conserving ways.
- 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.

## PART 1 MEDICAL-SURGICAL CASES

12. What referrals could you consider at this time and why?
- Occupational therapist (OT) consultation. The OT can show C.E. and his wife how to accomplish tasks in the most energy-efficient way.
  - Pulmonary rehabilitation program. These multidisciplinary programs for patients with moderate to severe lung disease focus on symptom reduction and improved quality of life. They typically include exercise training, smoking cessation, nutrition counseling and education.

## CASE STUDY PROGRESS

The next few visits are uneventful. C.E. has continued to not smoke and is doing better with managing episodes of dyspnea. At your next visit, you greet C.E., immediately note that he sounds congested, and comment that he 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."

13. What is your immediate concern and why?  
Your immediate concern is that C.E. has developed an infection that can cause damage to lung tissue. People such as C.E. do not have a lot of lung reserve and can suffer temporary or permanent loss of function from a pulmonary infection.
14. What assessment do you need to perform?
- Obtain complete vital signs (VS) with Spo<sub>2</sub> on room air.
  - Physical assessment, focusing on cardiovascular and pulmonary components and determination of mental status.
15. You do not find any signs of an infection. 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.
16. What basic hygiene measures would you include in a teaching plan for C.E. and his wife to prevent his developing an infection? Select all that apply.
- Practice good hand washing technique, and wash hands often.
  - Avoid people with cold and flu infections, and screen visitors.
  - Avoid enclosed, public areas at all times.
  - Get pneumonia and flu vaccines every year.
  - Use the dishwasher to wash eating utensils, glasses, and plates.
  - Use antibacterial wipes daily to clean frequently touched surfaces.
- Answers: a, b, e, f  
He only needs to avoid enclosed, public spaces during cold and flu season. The pneumonia vaccine is given every 5 years.
17. C.E.'s wife says she would like to read more about emphysema on the Internet. List two credible resources to which you could direct her.  
Credible resources include:
- American Lung Association: [www.lungusa.org](http://www.lungusa.org) (in the United States)
  - The Lung Association: [www.lung.ca](http://www.lung.ca) (in Canada)
  - National Heart, Lung, and Blood Institute: [www.nhlbi.nih.gov/index.htm](http://www.nhlbi.nih.gov/index.htm)



## Case Study 29 COPD Exacerbation

**Difficulty:** Advanced

**Setting:** Hospital

**Index Words:** chronic obstructive pulmonary disease (COPD), medications, nutrition, patient education, assessment, coping

**Giddens Concepts:** Clinical Judgment, Collaboration, Gas Exchange, Nutrition, Oxygenation, Safety

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Collaboration/Managing Care, Gas Exchange, Nursing Interventions, Nutrition, Oxygenation, Safety

### Scenario

D.Z., a 68-year-old man, is admitted at 1600 to a medical floor with a diagnosis of acute exacerbation of chronic obstructive pulmonary disease (COPD). His other past medical history includes hypertension and type 2 diabetes. He has had pneumonia yearly for the past 3 years and has been a two-pack-a-day smoker for 38 years. His current medications include enalapril (Vasotec), hydrochlorothiazide (HCTZ), metformin (Glucophage), and fluticasone/salmeterol (Advair). He appears a cachectic man who is experiencing difficulty breathing at rest. D.Z. seems irritable and anxious; he complains of sleeping poorly and states that lately he feels tired most of the time. He reports cough productive of thick yellow-green sputum. You auscultate decreased breath sounds, expiratory wheezes, and coarse crackles in both lower lobes anteriorly and posteriorly. His vital signs (VS) are 162/84, 124, 36, 102° F (38.9° C), and Spo<sub>2</sub> 88%.

### Chart View

#### Physician's Orders

Diet as tolerated  
 Out of bed with assistance  
 Oxygen (O<sub>2</sub>) to maintain Spo<sub>2</sub> 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) daily  
 Sputum culture  
 Albuterol 2.5 mg plus ipratropium 250 mcg nebulizer treatment STAT

- Are D.Z.'s VS and Spo<sub>2</sub> acceptable? If not, explain why.
  - His BP is elevated.
  - Pulse is tachycardic (124 beats/min) and respirations are rapid (36 breaths/min) because of hypoxemia.
  - Temperature is elevated and may indicate an inflammation or infection.
  - Oximetry reading is low (88%) because of poor diffusion of O<sub>2</sub> across alveolar membrane.
  - Hypoxemia has contributed to anxiety, and anxiety is making the hypoxemia worse.

## PART 1 MEDICAL-SURGICAL CASES

2. Describe a plan for implementing these physician's orders.  
Using an ABCD (Airway, Breathing, Circulation, Disability) system, the first actions are to initiate oxygen at 2 L per nasal cannula and administer the albuterol 2.5 mg plus ipratropium 250 mcg nebulizer treatment. Place him on an electrocardiogram (ECG) monitor and initiate the IV fluid. Order the CXR examination and obtain the blood work, and perform a physical assessment. Obtain the sputum culture as soon as he can provide a specimen. Order him a dinner tray and allow him out of bed at your discretion.
3. What is the primary nursing goal at this time?  
The nursing priority right now is to improve D.Z.'s respiratory status.
4. Based on this priority, identify three independent nursing actions you would implement.  
*Positioning:* Either keep him in bed with the head of the bed elevated or have him sleep in a chair that has arm rests. Elevating his arms lifts the rib cage so the respiratory muscles do not have to accomplish the work; this position decreases the work of breathing and allows greater 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.
5. Identify three expected outcomes for D.Z. as a result of your interventions.
  - Subjective reports of decreased dyspnea at rest
  - A decrease in respiratory rate
  - An increase in Sp<sub>o</sub><sub>2</sub>
  - A decrease in heart rate

## Chart View

## Medication Administration Record

Methylprednisolone (Solu-Medrol) 125 mg IVP every 8 hours  
 Azithromycin (Zithromax) 500 mg IVPB q24h × 2 days then 500 mg PO × 7 days  
 Fluticasone/salmeterol (Advair) 100/50 mcg 2 puffs twice daily  
 Heparin 4000 units subcut every 12 hours  
 Enalapril (Vasotec) 10 mg PO daily  
 Albuterol 2.5 mg/ipratropium 250 mcg nebulizer treatment every 6 hours  
 Metformin (Glucophage) 500 mg PO twice daily

6. Indicate the expected outcome for D.Z. that is associated with each medication he is receiving.
  - Methylprednisolone (Solu-Medrol) is an anti-inflammatory medication that will be used to decrease inflammation of the airways.
  - Azithromycin (Zithromax) is a broad-spectrum antibiotic that will kill or suppress the growth of microorganisms, including those causing respiratory infections.
  - Albuterol is a fast-acting beta<sub>2</sub> 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 and of the airways resulting in the easing of airway constriction.

- Heparin is an anticoagulant that will be used to prevent deep vein thrombosis.
  - Enalapril (Vasotec) is an ACE inhibitor, which will be used to control D.Z.'s BP.
  - Metformin (Glucophage) is a biguanide agent used to control hyperglycemia in type II diabetes.
7. Because D.Z. is on azithromycin (Zithromax), what interventions need to be included in his plan of care? Select all that apply.
- Monitor intravenous (IV) site for inflammation or extravasation.
  - Assess liver function study results and bilirubin levels.
  - Request a hearing test before initiating therapy.
  - Carefully dilute the medication in the proper amount of solution.
  - Place D.Z. on intake and output.
  - Administer the medication over 30 minutes.

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 1 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.

8. D.Z is ordered heparin 4000 units subcutaneous q12h. 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

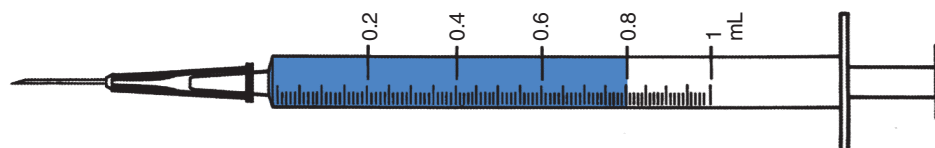
Usual Dosage: See insert.

**Fujisawa USA, Inc.**  
Deerfield, IL 60015-2548

40213F

LOT

EXP



## PART 1 MEDICAL-SURGICAL CASES

9. What are two common side effects of bronchodilators that you need to assess for?
- Tremors
  - Tachycardia
  - Anxiety (a side effect of the medication and of tachycardia)
10. You deliver D.Z.'s dietary tray, and he comments on 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 has not 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.
- CHO breaks down into  $\text{CO}_2$ , which is eliminated by the respiratory system; increased  $\text{CO}_2$  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 dyspnea and becomes anorectic. Another theory is that food mechanically presses upward on the diaphragm, limiting tidal volume ( $V_T$ ) and worsening dyspnea. Alternatively, he may have eaten too quickly and become too tired to eat any more.
11. Identify four interventions that might improve his caloric intake.
- Review his diet to ensure that it is 40% to 55% CHO, 30% to 40% fat, and 15% to 20% protein.
  - Provide six 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.
  - Request that a registered dietitian (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 medical nutrition therapy (MNT).
12. You notice a box of dark chocolate on D.Z.'s overbed table. He tells you that his wife brought him those because he always wakes at night and eats four or five pieces. What is thought to be the basis for this craving for chocolate?
- Chocolate contains theobromine, which acts to relax smooth muscles, including those of the bronchioles, improving air exchange and lessening dyspnea.
13. After speaking with D.Z. about his diet and reviewing his medications, you are now concerned about his glycemic control. Hospital policy allows you to obtain as-needed blood glucose levels for diabetic patients, so you direct the nursing assistive personnel (NAP) to obtain D.Z.'s blood glucose level at 2100. What is your responsibility in delegating this task to the NAP?
- First, you must provide clear directions to the NAP to obtain the blood glucose level at 2100. After that, it is your responsibility to see that the blood glucose level is obtained as directed and that the results are reported to you in a timely manner.
14. The NAP reports that D.Z.'s blood glucose level is 366 mg/dL. What action do you need to take and why?
- You would double-check the result by either performing a second capillary test or reviewing results from the latest chemistry panel. If a second test result is elevated, you would need to notify the physician so that routine blood glucose monitoring and sliding scale insulin can be initiated. D.Z.'s blood glucose level is likely elevated because of his receiving corticosteroids and the presence of inflammation. If his blood glucose levels remain elevated, it may take him longer to recover from this episode; if they continue to rise, he could develop diabetic ketoacidosis.



15. What other health care professional would probably be involved in D.Z.'s treatments and how?  
**Most likely a respiratory therapist would be involved in his care, particular in pulmonary toilet and administration of nebulization treatments.**

### CASE STUDY PROGRESS

The next morning, D.Z. is sitting in the bedside chair and appears to be experiencing less difficulty breathing. He states his cough remains productive of yellow-green sputum, although it is “easier to cough up” than it was the previous day. You auscultate decreased breath sounds and a few coarse crackles in both lower lobes posteriorly. His VS are 150/78, 94, 24, 99.7° F (37.6° C). His Spo<sub>2</sub> is 92% with oxygen on at 2 L per nasal cannula.

### Chart View

#### Arterial Blood Gases (ABGs)

pH	7.34
Paco <sub>2</sub>	58 mm Hg
HCO <sub>3</sub>	32 mmol/L
Pao <sub>2</sub>	65 mm Hg
Sao <sub>2</sub>	92%

16. Interpret D.Z.'s ABG values.  
**D.Z. has compensated respiratory acidosis, which is expected in a patient with COPD. If he would have been developing respiratory failure, the pH would be acidotic and the Pao<sub>2</sub> would decrease, resulting in uncompensated respiratory acidosis and tissue hypoxia.**
17. Has D.Z.'s status improved or not? Defend your response.  
**Yes, his status has improved. His ABGs are as expected for a patient with chronic COPD and do not reflect signs of impending respiratory failure. His VS have improved, although he is still running a slight fever. His dyspnea has improved and his sputum is less thick.**
18. What interventions would you include in your plan of care for D.Z. today?
- Monitor VS and lung sounds every 2 to 4 hours.
  - Titrate oxygen therapy to maintain saturation greater than 90%.
  - Administer medications as prescribed, and monitor effectiveness of therapy.
  - Encourage D.Z. to ambulate as tolerated, balancing activity with periods of rest.
  - Encourage fluid intake, and administer IV fluids as ordered.
  - Monitor blood glucose levels as ordered.

### 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. 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

**PART 1 MEDICAL-SURGICAL CASES**

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."

**19. 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 staff, who can arrange respite care for D.Z.'s wife—perhaps a 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, lung cancer, respiratory failure, pain management, assessment, National Patient Safety Goal, rapid response

**Giddens Concepts:** Clinical Judgment, Collaboration, Gas Exchange, Oxygenation, Pain, Safety

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Collaboration/Managing Care, Gas Exchange, Nursing Interventions, Oxygenation, Pain, Safety

### ► Scenario

The intensive care unit (ICU) nurse calls to give you the following report: "D.S. is a 66-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 and lower lobe lobectomy; the pathology report showed adenocarcinoma. He has no neurologic deficits. His vital signs run 120/70, 110, about 30, with a fever around 100.2° F. His heart tones are clear, all peripheral pulses are palpable, and he is receiving IV D5 ½ NS at 50 mL/hr in his right forearm. He has a right midaxillary chest tube to Pleur-evac drain; there is no air leak, and it is draining small amounts of serosanguineous fluid. He has complaints of pain at the insertion site, but the site looks good, and the dressing is dry and intact. He is on 5 L oxygen by nasal cannula. He refuses pain medication. He is a real nervous person and has not 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?

*Cardiovascular (CV):* What is his cardiac rhythm? Any edema?

*Respiratory:* What has his Sp<sub>o</sub><sub>2</sub> been running? Breath sounds? Coughing? Any respiratory treatments? Last chest x-ray examination? Any respiratory distress? How is he tolerating reduced lung volume?

*Gastrointestinal (GI):* Has he been eating? Diet order? Any stools, bowel sounds? When was his last bowel movement? How is his weight?

*Genitourinary (GU):* What does his urine look like? What is the output? Does he have a Foley catheter? What are his intake and output trends?

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

### 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 will not 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).

## PART 1 MEDICAL-SURGICAL CASES

3. Describe four things you need to do right now for D.S.
  - Raise the right upper side rail of the bed.
  - 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 vital signs and Spo<sub>2</sub>.
  - Perform a focused assessment. Evaluate lung sounds, chest tube site, and all of the peripheral equipment, including oxygen, chest tube, and IV line.
  - Tell him that you understand that his chest tube is causing pain. Ask him to describe the pain and rate it on a 0 to 10 scale. You want to know whether the pain is sharp or dull, constant or intermittent, and localized or generalized. Does the pain stay in one place or radiate somewhere else? What relieves it, and what makes it worse? Investigate the reason he has refused to take pain medication since surgery.
  - Orient him to the room and 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 pain medication is ordered to relieve the pain so that he can move around, cough and deep breathe, and recover faster with fewer complications. Moving and coughing will keep fluid from accumulating in his good lung, preventing pneumonia. 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 few days after surgery; after that, they do not need as much medication and can take only as much as they need. Explain that if he waits until the pain is intense it will take larger amounts of pain medication to relieve the pain.
  - 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.
5. Which of the following nonpharmacologic methods of pain relief would most likely help D.S. at this time? Select all that apply.
  - a. Distraction
  - b. Hypnosis
  - c. Positioning
  - d. Acupuncture
  - e. Biofeedback

Answers: a, c

Nonpharmacologic interventions that should assist D.S. in pain management at this time include simple measures such as supporting the patient in a comfortable position using pillows and encouraging regular changes of position, and using distraction through music, television, visitors, computer use, or any other means preferred by the patient. Hypnosis, biofeedback, and acupuncture are useful for managing some pain syndromes; however, these syndromes are usually more chronic in nature and not acute, as would be the case with thoracic surgery.

6. D.S. is experiencing difficulty using his right arm. Given the type of surgery he underwent, is this expected and why?  
*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 experiences a transient nerve compression and restricted use of the arm on the affected side.*
7. 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 of aspiration.
  - Grab a basin and place it beside his mouth.
  - Apply a cool washcloth to his head.
  - Ask him when he began to feel nauseated.
8. 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." What do you think is responsible for the sudden onset of nausea?  
*Nausea is most likely associated with the administration of the morphine.*
9. Would it be appropriate to give D.S. a second dose of morphine? State your rationale.  
*No, it would not be appropriate to subject D.S. to a second dose of morphine. There are many alternative medications the physician could order that may not have an adverse effect on D.S.*
10. You decide to call the physician to report the reaction. Using SBAR, what would you report to the physician?  
*You would first identify yourself and the patient, stating the diagnosis and how many days postoperative he is. Then describe the situation, focusing on the administration of the morphine and D.S.'s reaction to the morphine. Inform the physician that D.S. had not received anything for pain since surgery. Review the earlier assessment findings, any interventions you performed, and D.S.'s current status. Conclude your remarks with the belief that D.S. will continue to experience nausea with the use of the morphine and ask if D.S. could be placed on an alternative medication, such as fentanyl or hydrocodone. Request something to relieve the nausea, such as ondansetron (Zofran).*
11. The physician changes D.S.'s pain medication to fentanyl and orders ondansetron (Zofran) 4 mg IV every 6 hours as needed for nausea. You use a floor-stocked multidose vial to administer the first dose. How many milliliters of Zofran will you administer?

<p>NDC 0173-0489-00 <i>GlaxoWellcome</i></p> <p><b>Zofran<sup>®</sup></b>  <b>(ondansetron hydrochloride)</b>  <b>Oral Solution</b></p> <p><b>4 mg/5 mL</b></p> <p><b>Caution:</b> Federal law prohibits dispensing without prescription.</p> <p><b>50 mL</b></p>	<p>Each 5 mL contains 5 mg of ondansetron HCl dihydrate equivalent to 4 mg of ondansetron.</p> <p>See package insert for Dosage and Administration.</p> <p>Store between 15° and 30°C (59° and 86°F). Protect from light. Store bottle upright in carton.</p> <p>Glaxo Wellcome Inc.          Research Triangle Park, NC 27709          Made in England          4058968          Rev. 3/96</p>
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**Answer: 7.5 mL**

## PART 1 MEDICAL-SURGICAL CASES

12. 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 a 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 the 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. An unsecured 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 afternoon, the nurse giving you D.S.'s report says that he has been driving her crazy all morning. 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. He is sitting on the side of the bed with his arms hunched up on the overbed table. 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."

13. 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
  - Congestive heart failure
  - Acute Respiratory Distress Syndrome
14. What actions will you take next? Give your rationale.
- Increase his O<sub>2</sub> (start on 100% non-rebreather mask).
  - Obtain VS and oxygen saturation.
  - Auscultate breath sounds.
  - Note respiratory pattern and use of accessory muscles.
  - Check patency of chest drainage system.
  - Observe skin color and moisture.

## CASE STUDY PROGRESS

D.S.'s respiratory rate is 46. You auscultate slight air movement over the large airways and no breath sounds distal to the third intercostal space. The chest drainage system is intact. 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.

15. What will you do next?
- Call for the rapid response team. His tidal volume is inadequate to support life; he is creating an O<sub>2</sub> deficit and could go into respiratory arrest at any moment.



16. The rapid response team stabilizes D.S. and you accompany him during transfer to the ICU. Why do 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 and then explain that D.S. is experiencing respiratory distress. State that D.S. is postoperative day 4 after right middle lobe (RML)/right lower lobe (RLL) lobectomy for adenocarcinoma; then give current VS and details of his respiratory examination findings, 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 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 next day the nurse who gave you his report comes 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 does not put another patient through what D.S. experienced.

17. How do you distinguish between early and late stages of respiratory failure?

Early Respiratory Failure	Late Respiratory Failure
Increased respiratory rate	Respiratory rate over 30 breaths/min
Decreased $V_T$	Breath sounds very decreased or absent
Increased use of accessory muscles	Use of accessory muscles of respiration
Breathlessness while talking	Muteness
Tachycardia	Cold, clammy skin
Pulsus paradoxus 10 to 25 mm Hg	$Pao_2$ less than 55 mm Hg and $Paco_2$ over 45 mm Hg
Agitation	Inability to recline
Loss of energy; focused on breathing	Paradoxical thoracoabdominal movement

#### CASE STUDY OUTCOME

D.S. experiences no further complications and completely recovers from the lobectomy after 2 months. He receives 6 months of external beam radiation therapy to the chest. His chest x-ray examination at 5 years shows no recurrence.







## Case Study 31 Acute Respiratory Distress Syndrome

**Difficulty:** Advanced

**Setting:** Hospital

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

**Giddens Concepts:** Clinical Judgment, Collaboration, Fluid and Electrolyte Balance, Gas Exchange, Oxygenation, Safety

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Collaboration/Managing Care, Fluid and Electrolyte Balance, Gas Exchange, Oxygenation, Safety

### ► Scenario

G.S., a 56-year-old secretary, was involved in a motor vehicle accident; a car drifted left of the centerline 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, right hemothorax and pneumothorax, fractured spleen, multiple small liver lacerations, open fractures of both legs, and probable cardiac contusion. She was taken to the operating room (OR) for repair of her injuries. In the OR she received 36 units of packed red blood cells (RBCs), 20 units of platelets, 12 units of fresh frozen plasma, and 18L of lactated Ringer's solution. G.S. was admitted to the intensive care unit (ICU) postoperatively, where she developed acute 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 cause 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, disseminated intravascular coagulation (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 sustained extensive trauma.**

### CASE STUDY PROGRESS

G.S. was in the ICU for 4 weeks, and her ARDS is almost resolved. She is being transferred to your unit. The ICU nurse gives you the following report: "She is awake, alert, and oriented to person and place. Both legs remain casted from hip to toe. She can wiggle her toes on both feet. Heart tones are clear, last vital signs were 138/90, 88, 26, 99.3° F (37.4° C); bilateral radial pulses 3+. All of her surgical incisions are 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 left double-lumen peripherally inserted central catheter (PICC) line. Her morning labs are still pending."

## PART 1 MEDICAL-SURGICAL CASES

3. What additional information do you need from the ICU nurse?

*Neurologic:* Does she have any motor or sensory deficits? Pupil reactivity? Does she wear or have glasses? Is she experiencing any pain?

*Cardiovascular:* Has she been febrile? What is her cardiac rhythm? Any edema? Is she receiving any IV fluids? Is the PICC line patent?

*Skin:* What is the skin condition? Is there any breakdown? Have there been complications of surgery? Are pins or other tubes present?

*Respiratory:* Is she on O<sub>2</sub>? What has her SpO<sub>2</sub> 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 chest x-ray examination? *Gastrointestinal:* Is she taking any oral intake? What type of tube feeding and rate of infusion? Any guaiac-positive drainage from anywhere? Any stools, bowel sounds? When was her last bowel movement? Have her describe it (soft or hard, formed or loose, large or small, and so on). How is her weight?

*Genitourinary:* 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 past medical history? Are there any family members? If so, any problems with them? Belongings? What medications is she on?

## CASE STUDY PROGRESS

You complete your assessment of G.S. You note she is dyspneic and has fine crackles throughout all lung fields posteriorly and in both lower lobes anteriorly, and coarse crackles over the large airways. She has oxygen on at 2 L per nasal cannula and her SpO<sub>2</sub> is 94%.

4. What is the significance of the fine and coarse crackles?

Fine crackles indicate fluid accumulation in the pulmonary or parenchymal tissues that might result in impaired gas exchange. Edematous pulmonary tissue exerts pressure on distal airways. When this pressure exceeds intra-airway pressure, the airways prematurely collapse or pop closed. Conversely, when intra-airway pressure exceeds pulmonary 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 fine 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 scheduled furosemide (Lasix) 60 mg intravenous push (IVP). What effect, if any, should furosemide have on G.S.'s breath sounds?

Furosemide, a diuretic, will mobilize and increase excretion of excess fluids from the body, including pulmonary fluids. Decreasing pulmonary edema should result in fewer fine crackles.



7. What action do you need to take before giving the furosemide?

You need to check for the results of the pending laboratory values, particularly potassium and calcium, because furosemide can cause electrolyte depletion.

**Chart View****Laboratory Results**

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

8. Which laboratory values concern you, and why?

Because you are about to administer furosemide, you are concerned that the sodium, potassium, and calcium are low. Each of these values is likely to decrease further after administration of furosemide. 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 G.S.'s laboratory values, what action do you need to take and why?

Because several values fall outside the normal range and a life-threatening situation may occur with administering the furosemide, you need to call the physician to report the abnormal laboratory values so that the patient can be appropriately treated.

**CASE STUDY PROGRESS**

The physician wants you to administer the furosemide and prescribes the following.

**Chart View****Physician's Orders**

STAT magnesium (Mg) level  
 Potassium chloride (KCl) 40 mEq IVPB  
 Calcium gluconate 2 g in 100 mL NS IVPB over 3 hr

10. Why did the physician order a magnesium level?

Because the Na, K, and Ca are low, there is a strong possibility that the magnesium level is also low. Checking the magnesium level would enable the physician to determine if replacement therapy is needed.

11. G.S. has one available port to use on the PICC line. Outline a 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.

## PART 1 MEDICAL-SURGICAL CASES

12. What interventions do you need to perform to safely administer intravenous (IV) potassium chloride? Select all that apply.
- Place G.S. on continuous electrocardiogram (ECG) monitoring.
  - Administer the infusion using an intravenous pump.
  - Assess the patency of the PICC line before initiating the infusion.
  - Administer the potassium infusion over a time period of at least 2 hours.
  - Invert the potassium-containing IV bag several times before and during the infusion.

Answers: a, b, c, e.

For the KCl, no more than 10 mEq would typically be administered per hour, making the minimum infusion time 4 hours. During the infusion, you would need to ensure that G.S. is on a cardiac monitor. Using an IV pump assists in assuring the proper infusion rate. To keep the potassium evenly distributed in the solution, invert the bag several times before initiating and during the infusion. Because potassium is caustic to the veins, check the patency of the PICC site before initiating the infusion.

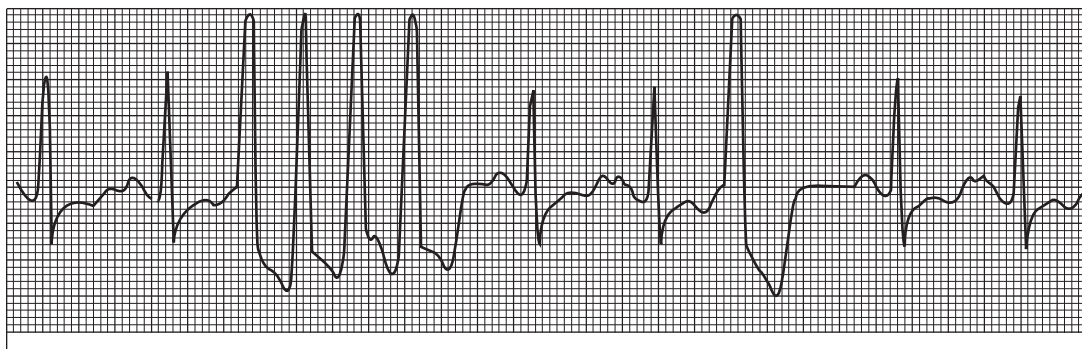
13. You go to prepare G.S.'s furosemide dose and find only one 20-mg vial in the medication-dispensing system. The floor stock is empty. The pharmacist tells you that it will be at least an hour before he can send the drug to you. What are your options?

You could offer to send someone to the pharmacy to obtain the medication or send another staff member to check the floor stock on another floor. If you are unable to locate 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 physician. Chart your actions and rationale.

14. While you are administering the furosemide, 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?

- Connect G.S. to a monitor or call for a STAT 12-lead ECG to verify heart rhythm.
- Determine whether G.S. has a conducted pulse; note the rate and regularity.
- If she has a pulse, take her blood pressure (BP) and determine whether she is symptomatic.
- Monitor her ABCs. If she loses her pulse, call for help and begin CPR.

15. G.S.'s pulse is 66 beats/min and irregular. Her blood pressure 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." Interpret what you see.



G.S. is having frequent premature ventricular contractions (PVCs), including one four-beat run of ventricular tachycardia.

16. Why is G.S. likely experiencing a dysrhythmia?

Her dysrhythmia is likely a result of a combination of low K, Ca, and Mg levels and low oxygen levels secondary to pulmonary congestion.

17. What will your next actions be?

- Administer oxygen therapy at the ordered concentration.
- Begin the KCl and Ca gluconate IVPBs as quickly as possible.
- Place her on ECG monitoring. Call for a STAT 12-lead ECG to confirm cardiac rhythm.
- STAT page the physician.
- Establish additional IV access.

### Chart View

#### Arterial Blood Gases (ABGs) on 6 L O<sub>2</sub> by Nasal Cannula (NC)

pH	7.30
Paco <sub>2</sub>	59 mm Hg
Pao <sub>2</sub>	82 mm Hg
HCO <sub>3</sub>	36 mmol/L
SpO <sub>2</sub>	91%

18. You increase her oxygen to 6 L and the physician orders a stat set of ABGs. 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 Pao<sub>2</sub> level reflects poor pulmonary perfusion.

19. What are your nursing priorities at this time?

The priority of care at this time is to stabilize her cardiac status and improve her respiratory status.

20. Describe four interventions you will perform over the next few hours based on this priority.

- Continue the oxygen per protocol.
- Elevate the head of her bed.
- Frequent monitoring of vital signs with continuous ECG and Sao<sub>2</sub> monitoring.
- Maintain the electrolyte infusions.
- Auscultate lung sounds every 1 to 2 hours.
- Encourage her to cough and deep breathe and use the incentive spirometer (IS) every 2 hours.
- Administer an as-needed medication for anxiety.

**PART 1 MEDICAL-SURGICAL CASES**

21. 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. Sometimes people have abnormal heartbeats. 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 are usually caused by one of two things: either your heart muscle is not getting enough oxygen, or you do not have enough of certain minerals such as potassium, calcium, or magnesium in your blood. We are trying to determine the reason you are having those abnormal beats. I have already turned up your oxygen and started an IV that has potassium and calcium in it, but I cannot give it too fast because that could cause other problems. The laboratory technician drew your magnesium level about an hour ago, so we will have that result soon. I'll keep you informed as we get more information." Then ask G.S. if there is anyone you could call to come and keep her company. See if 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.

**CASE STUDY OUTCOME**

G.S.'s pulmonary status does not improve after administration of the furosemide and she continues to have frequent ventricular dysrhythmias despite the administration of the electrolytes. The physician transfers G.S. back to the ICU, where she is found to have a pulmonary embolus. Unfortunately, 1 week later she throws another embolus and all attempts at resuscitation fail.