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The 4th edition of MedSurg Notes includes new quality, safety, rescue, and outcome indicator icons (see Key, below) to help you identify important interventions critical to safe, high quality patient care.

Quality indicator (QI) icons signify interventions associated with improved outcomes. Safety indicator (SI) icons point out actions the nurse takes to secure a safe environment for the vulnerable patient. Rescue indicator (RI) icons let you know that the patient’s condition is unstable and that you must call a physician, physician’s assistant, or nurse practitioner to the bedside immediately. Outcome indicator (OI) icons highlight the immediate goals of care, which will help guide your actions and prioritize interventions.

KEY:

- **QI** = Quality indicator
- **SI** = Safety indicator
- **RI** = Rescue indicator
- **OI** = Outcome indicator

Remember that thorough assessment, conscious critical thinking, appropriate nursing interventions, patient advocacy, and the prompt notification of medical or advanced practice nursing staff will improve the health care outcomes of your patients.
Rapid Cardiovascular Assessment

Timely focused assessments are critical. Remember that detection of signs and symptoms as they evolve is key.

- **Assess the following cardinal symptoms and red flags immediately:**
  - Chest pain with or without neck, jaw, or left arm pain.
  - Chest pressure, tingling, squeezing, viselike pain.
  - Severe indigestion (may be more common in women).
  - Shortness of breath (SOB), dyspnea on exertion, decreased pulse oximetry.
  - Tachycardia—first sign of hypoxemia, palpitations.
  - Weakness and feelings of extreme fatigue.
  - Dizziness, syncope, sweating, nausea, vomiting, fatigue.
  - Cyanosis of lips, fingers, or nailbeds.
  - Pain, coolness, pallor, or pulse changes in extremities.
  - Electrolyte abnormalities, especially low potassium levels.

- **Check vital signs (VS).**
  - Assess blood pressure (BP), heart rate (HR), respiratory rate (RR), oxygen saturation (SaO₂).
  - Calculate pulse pressure if indicated (systolic blood pressure [SBP] minus diastolic blood pressure [DBP]). Pulse pressure should be about 40 mm Hg.
  - Calculate mean arterial pressure (MAP): (2DP) + SBP ÷ 3 (see Basic Hemodynamics, p 2).

- **Auscultate heart and lungs.**
  - Listen to heart sounds to detect abnormalities.
  - Check if radial pulse is felt with each heartbeat auscultated.
  - Listen for crackles in lung bases, which suggest heart failure.

- **Assess mental status.**
  - Impaired cardiac function can cause low cardiac output, which results in less blood getting to the brain.
  - Look for restlessness, ↓ level of consciousness (LOC), confusion, anxiety.

- **Assess extremities.**
  - Impaired cardiac function can result in decreased peripheral perfusion.
  - Check skin temperature and capillary refill time: **Cold extremities and/or slow capillary refill indicate reduced perfusion.**
Note changes in skin color: Cyanosis, reddish mottled skin, paleness, or grayish tone indicate reduced perfusion.
Assess for presence and equality of pedal pulses. (If pulses are not palpable, use a Doppler sonogram.)
Assess for edema of lower extremities (check sacrum if patient is bedridden).

Basic Hemodynamics

If you want to understand and be part of the discussion with doctors and other nurses about care of the patient with cardiovascular problems, you must have a basic understanding of hemodynamics.
Hemodynamics is the study of blood circulation, cardiac function, and peripheral vascular functioning.
The ultimate goal of trying to manipulate hemodynamics in the critically ill patient is to ensure a cardiac output sufficient to perfuse the organs and tissues. Without oxygen and nutrients, cells cannot carry out their basic functions.
Basic hemodynamic monitoring can be done on the medical-surgical unit without invasive lines by assessing:
BP, HR.
Peripheral perfusion, edema, jugular vein distention, intake and output (I&O).
Pulse oximetry, lung sounds.
Mental status, renal function.
Read more about these concepts in your textbooks. This discussion focuses mainly on the left heart and arteries, but the principles apply to the right heart as well.

Cardiac Output—The Bottom Line

An adequate cardiac output (CO) is necessary to perfuse the organs and peripheral tissues. Adequate perfusion brings a continuous and ample supply of O₂ and glucose to the cells for aerobic metabolism and the production of adenosine triphosphate (ATP).
Remember that ATP is the primary source of energy for the body. Every movement, thought, chemical process, or protein synthesis—in short, everything your body does—requires ATP. Without it, all these processes begin to fail. Aerobic
metabolism creates approximately 38 molecules of ATP per molecule of glucose.

- If too little oxygen and glucose are delivered to the tissues, aerobic metabolism ceases, and anaerobic metabolism takes over. Anaerobic metabolism creates only two molecules of ATP per molecule of glucose.
- Anaerobic metabolism therefore results in markedly less energy for bodily processes. It also creates lactic acid, which can lead to acidosis. These are the consequences of impaired CO.
- Many medical interventions, especially in seriously ill or unstable patients, are based on improving CO.
- Cardiac output = the volume of blood pumped by the heart in 1 minute. It is determined by multiplying the amount of blood ejected with each heartbeat by the HR (see Stroke Volume).

\[ \text{CO} = \text{SV} \times \text{HR} \]

- Normal CO varies from 4 to 8 L/min in the adult, depending on body size. CO can only be measured using invasive monitoring, but the effects of a poor cardiac output can be readily seen.
- Cardiac index (CI) is cardiac output adjusted for body size (cardiac output divided by body surface area). It is a better way to assess if a patient’s cardiac output is adequate.
- Changes in HR, stroke volume, preload, contractility, and/or afterload affect CO.

**Heart Rate**

- The cardiac cycle is all the events that occur in a single heartbeat.
- Simply put, the ventricles must fill and then contract to eject blood.
- **Diastole** is the period of time when the ventricles are filling.
- **Systole** is the period of time when the ventricles are contracting.
- When HR is greater than 150 in adults with cardiac problems or as a result of a true rhythm disturbance such as paroxysmal atrial tachycardia, filling time decreases. Less blood in the ventricle means less blood is ejected, and cardiac output drops.
- **Irregular and/or rapid HR interferes with filling time, thus diminishing cardiac output.**
Stroke Volume (SV)

- Stroke volume (SV) is the amount of blood ejected with each heartbeat. Normal (at rest) stroke volume is 50 to 70 mL.
- Stroke volume can be measured accurately only during a cardiac catheterization or closely estimated during an echocardiogram.
- Stroke volume is the basis for determining CO. SV multiplied by HR equals cardiac output.
- Stroke volume is the result of preload, contractility, and afterload. You will hear these terms repeatedly, and you must have a basic understanding of what they mean. Many medications that you administer affect preload, contractility, and/or afterload.

Preload

- Preload is how much the cardiac muscle fibers have stretched by the end of diastole, which is when the left ventricle has filled and is ready to eject blood into the systemic circulation.
- The stretching is determined by the amount of blood in the left ventricle.
- Think of a water balloon: the more water added to the balloon, the more the balloon stretches. This is the concept of preload.
- The degree of stretching is correlated to the force of the contraction: the more stretch, the greater the contraction and the better the cardiac output (Starling’s law).
- There is an optimal degree of stretch. Overstretching or understretching weakens the contraction.
- Some clinical applications of the concept of preload:
  - Not enough preload:
    - When a patient has lost a lot of blood, preload forces are diminished due to too little blood returning to the heart. Replacement with intravenous (IV) fluids (IVF) or blood products increases circulating volume, which increases preload and CO.
    - When you elevate a patient’s legs, you redistribute blood to core organs and increase venous return. This adds volume in the left ventricle, which stretches the ventricle more, increasing preload and CO.
  - Too much preload:
    - When a patient is in fluid overload, the heart cannot handle the excess volume. Diuretics eliminate some of the volume and improve preload.
Reducing preload can help the ailing or infarcted heart by decreasing workload. Nitroglycerin (NTG) dilates the venous system, which causes more blood to remain in the peripheral circulation. This reduces preload, cardiac workload, and blood pressure.

Drugs that affect preload include vasodilators and diuretics. Many drugs affect both preload and afterload.

Contractility

Contractility is the capacity of cardiac muscle to develop the force required to pump blood efficiently.

This is where the term inotropy comes in. Understand it. It means the force of the muscle contraction.

Positive inotropes are drugs that increase the force of the contraction and enhance cardiac function.
  - Conditions that require use of positive inotropes include:
    – Decompensated heart failure.
    – Cardiogenic shock.
    – Septic shock.
    – Myocardial infarction (MI).
    – Cardiomyopathy.
  - Medications with positive inotropic effects include:
    – Digoxin.
    – Dopamine, dobutamine, epinephrine, norepinephrine.
    – Inamrinone, milrinone.
    – Calcium.

Negative inotropes are drugs that decrease the force of contraction and are used to reduce the workload on the heart.
  - Conditions in which negative inotropes are used include:
    – Angina, sometimes MI.
    – Heart failure.
    – Hypertension.
    – Dysrhythmias.
  - Medications with negative inotropic effects include:
    – Beta blockers.
    – Calcium channel blockers.
    – Some dysrhythmic drugs (quinidine, procainamide).
Afterload

- **Afterload** is the degree of tension (the “tightness”) in the arteries against which the left ventricle has to push when it pumps. Afterload is a function of systemic vascular resistance (SVR), pressures in the aorta, and the condition of the aortic valve.

- Think in terms of rapidly pushing fluid out of a syringe fitted with a very fine needle. Emptying the syringe quickly requires that you exert a lot of force through your thumb on to the plunger. If you change to a larger bore needle, pushing the fluid out quickly takes much less force. The gauge of the needle represents afterload, and the force you exert to depress the plunger represents the force the left ventricle must generate.

- When peripheral arterioles, capillaries, and venules are constricted (increased systemic vascular resistance), afterload is increased. This increases the workload of the heart and the amount of oxygen it needs. You can see the implications of increased afterload, for example, in the patient experiencing an MI whose BP is 170/90. Reducing afterload would lower BP and decrease cardiac workload.

- **Some clinical applications of the concept of afterload:**
  - Too little afterload:
    - In sepsis, peripheral blood vessels overdilate, greatly reducing SVR and BP. Vasoconstricting medications such as epinephrine tighten up the arterial bed and increase BP.
    - Too much of a vasodilating drug, such as hydralazine, overdilates the vessels and drops blood pressure too much.
  - Increased afterload:
    - Atherosclerosis causes stiffening of arteries, which increases systemic vascular resistance, afterload, and BP.
    - Aortic stenosis makes the valve stiff and hard to open. The left ventricle must generate greater than normal pressures to push open the valve and eject blood into the circulation.
    - Conditions that stimulate the sympathetic nervous system, which triggers vasoconstriction and increases afterload, include pain and anxiety. Nursing interventions that decrease pain and anxiety have a significant effect on afterload, thus reducing cardiac oxygen demand. *Do not underestimate this.*
Blood Pressure

- **BP may seem like a routine measurement, but if your patient’s BP drops and he looks pale and clammy, or if it shoots up to more than 200 systolic or 110 diastolic, it will not seem routine anymore.** Understand the implications of blood pressure numbers beyond whether it is high or low to become a more effective nurse.
- Blood pressure provides information about the heart, circulating volume, perfusion, arterial health, and more.
- The **systolic blood pressure** (top number) reflects the force applied to the arterial walls by the blood pushing against them during the contraction.

## Factors Affecting Preload, Contractility, and Afterload

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The **diastolic blood pressure** (bottom number) reflects the force applied to the arterial walls by the blood when the heart is not contracting.

Blood pressure is a function of three factors. *Understanding these factors is the basis for understanding treatment. Think about how these factors can be manipulated when a patient’s BP is abnormal to really understand the goals of treatment.* The factors are:

1. **Blood volume** (see Preload).
2. **Pumping action of the left ventricle** (see Contractility).
3. **Blood vessel tone** (see Afterload).

   - **Tone** is the degree to which blood vessels are either constricted or dilated; it has a profound effect on blood pressure.
   - Constriction of the small arteries, arterioles, and capillaries dramatically raises blood pressure. Likewise, dilation of these arterioles lowers blood pressure. Constriction and dilation are caused by multiple factors, including chemicals produced by the body, health conditions, and medications.
   - Moderately constricted is the normal state.
   - Blood vessel tone also is called **systemic vascular resistance (SVR)**—how “tight” or “relaxed” the vascular system is. The tighter the vascular system, the harder the heart has to pump. *Think in these terms—tight or relaxed vascular system—when you think about blood pressure, especially in urgent situations.*

### Mean Arterial Pressure

- **Mean arterial pressure (MAP)** is the average arterial blood pressure during a single cardiac cycle. Normal range is 70–110 mm Hg.
- MAP is used to gauge whether there is enough blood pressure to perfuse the heart, brain, kidneys, and other organs.
- MAP is calculated from the systolic and diastolic pressures.

\[
\text{DBP} = \text{diastolic pressure}; \text{SBP} = \text{systolic pressure}: \\
\text{MAP} = \frac{2 \times \text{DBP} + \text{SBP}}{3}
\]

- Example for a blood pressure of 110/80:
  1. *Multiply DBP \times 2:* \(80 \times 2 = 160.\)
  2. *Add systolic pressure to answer from step 1:* \(160 + 110 = 270.\)
  3. *Divide answer from step 2 by 3:* \(270 \div 3 = 90.\)
  4. *MAP = 90.*

   - Diastolic pressure is used twice because the diastolic phase (filling time) of a cardiac cycle is twice as long as the systolic phase (ejection time). This means that three numbers are added, which is why the total is divided by 3 to get the average.
If the patient has an arterial line, MAP is automatically calculated using a more complex, more precise formula.

Monitor MAP when the patient is at risk for poor perfusion, such as in patients who have:
- Heart failure.
- Shock.
- IV vasoactive medications infusing.
- Head injuries.

**Pulse Pressure**
- Pulse pressure (PP) is the difference between SBP and DBP. Normal is 40 mm Hg.

\[ PP = SBP - DBP \]

A pulse pressure >40 is an indicator of cardiac disease, especially in older adults. It suggests stiffening of the aorta from atherosclerosis and/or hypertension. It is also an indicator of aortic regurgitation—a leaky valve.

Low (or narrow) pulse pressure (<25) can mean significant blood loss, aortic stenosis, or heart failure.

These are all factors that affect preload, contractility, and afterload.

**Note:** A wide pulse pressure, especially with bradycardia, is an indicator of increasing intracranial pressure. It is an ominous sign in the neurology patient and must be reported immediately.

Pulse pressure is not used to determine treatment yet but is becoming important as a risk factor to be considered.

**CARDIOVASCULAR PROBLEMS AND DISORDERS**

**Abnormal Cardiac Rhythm**

**The Patient May Have . . .**
- Sensation of fluttering in chest, heart racing, or dizziness.
- Tachycardia, bradycardia, irregular rate.
- Cold and clammy skin, hypotensive (drop in BP ≥20 mm Hg from baseline).
- SOB, dyspnea, nausea.
- Anxiety, panicky feeling, rapid breathing (hyperventilation).
Immediate Interventions

1. Place patient supine in bed. Apply O₂ if available at bedside.
2. Take BP, and assess apical HR and rhythm. Compare apical rate to radial rate as one measure of perfusion.
3. Check for patent IV access.
4. Quickly assess perfusion by assessing mental status, peripheral pulses.
5. Observe cardiac monitor if patient is being monitored.
6. STAT page physician, physician assistant (PA), or nurse practitioner (NP) if patient is having short runs of ventricular tachycardia. Call a code for sustained V-tach or ventricular fibrillation.
7. Obtain rhythm strip to document event.
8. Notify physician, PA, or NP.
9. Document patient’s status, phone call to physician, PA, or NP, and physician, PA, or NP response.

Focused Assessment

1. Assess LOC, VS, and pulse rate quality and rhythm.
2. Assess precipitating event, pain level, anxiety, hyperventilation.
3. Assess breath sounds, SaO₂.
4. Assess peripheral pulses, skin temperature and color, edema.
5. Assess trends in pertinent laboratory data (e.g., hemoglobin [Hgb], hematocrit [Hct], electrolytes).
6. Obtain and assess laboratory data such as arterial blood gases (ABGs), cardiac enzymes.

Stabilizing and Monitoring

1. Determine whether abnormal rhythm is transient or sustained, is potentially life threatening (ventricular dysrhythmias), and whether cardiac output is affected.
2. Initiate appropriate treatment.
3. Continue to monitor rhythm; obtain and analyze rhythm strip every 4 hours and when rate or rhythm changes.
4. Continue to monitor VS and SaO₂.
5. Keep IV line patent, and infuse IVF or medications, as ordered.
6. Review laboratory data such as Hgb/Hct, blood urea nitrogen (BUN) and creatinine, electrolytes, other chemistries, blood glucose, and liver and cardiac enzymes.
7. Check medication administration record (MAR) for possible drug side effects or interactions.
8. Chart patient status, and convey to physician, PA, or NP.
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Be Prepared To
■ Obtain a 12- or 15-lead electrocardiogram (ECG).
■ Administer antiarrhythmic medication (e.g., procainamide, quinidine).
■ Obtain IV access and administer ordered IVF and medications.
■ Transfer patient to a unit with cardiac monitoring.
■ Assist with placement of temporary transvenous or external pacemaker or cardioversion.

Possible Causes
■ Premature atrial or ventricular contractions (PACs or PVCs) or other cardiac dysrhythmia; mitral valve prolapse; stress, anxiety; medications; hyperthyroidism; dehydration; hemorrhage; heart failure; adrenal crisis; hypoglycemia.

Arterial Bleeding

The Patient May Have . . .
■ Pulsatile bleeding that spurs out of the wound/puncture site.
■ Pressure dressing over an arterial insertion site is saturated with blood.
■ Cannulated artery that has been inadvertently decannulated and is hemorrhaging.

Immediate Interventions
■ Have someone else notify physician, PA, or NP. If you are alone, pull out the call bell so that it will flash or use other facility method for summoning help in an emergency.
  \[\text{\textbf{RI}}\]  STAT! If the original dressing is off and there is frank, pulsatile bleeding, put on clean gloves, gown, and eye shield (if immediately available), fold several sterile dressings, and apply them with strong pressure 2 cm above the site. Use the flat portion of your fingers or the palm of your hand for 10 minutes or more.
■ Follow the same procedure if the dressing is intact but saturated with blood.
■ Elevate extremity above the heart to decrease blood flow.
■ Use more gauze pads if necessary, but do not remove original pads/dressings because doing so can interrupt clotting.
■ Do not apply a tourniquet unless the bleeding is so voluminous that the patient will die if it is not controlled. Use of tourniquets can result in necrosis of distal tissue and limb loss.
■ Document patient’s status, phone call to physician, PA, or NP, and physician, PA, or NP response.
Focused Assessment
- Monitor distal pulses and sensation of affected limb.
- Assess VS and evaluate for signs of shock such as decreased BP or tachycardia.
- Assess skin color, temperature, and moistness; cool, pale, clammy skin is an indicator of low blood pressure and shock.
- Assess LOC; be alert for confusion or restlessness, which can indicate shock.

Stabilizing and Monitoring
- Bleeding controlled, stable VS and LOC at desired baseline, blood transfusion started, if ordered.
- Once bleeding is controlled, apply sterile gauze dressing overlaid with a pressure dressing (such as Elastoplast). Depending on institution protocol, use a sandbag or other device over the dressing for added pressure.
- Document patient’s status, phone call to physician, PA, or NP, and physician, PA, or NP response.
- Instruct patient to maintain supine position a minimum of 6 hours.
- Frequently assess site for rebleeding into dressings or swelling.
- Monitor circulation, mobility, and sensation in affected extremity.
- Frequently monitor VS for changes in BP and HR.
- Assess for history of preexisting conditions such as clotting abnormalities or blood dyscrasias or for recent/current administration of antiplatelet or anticoagulant medications.
- Chart patient status and convey to physician, PA, or NP.

Be Prepared To
- Assist physician, PA, or NP with emergency treatment.
- Obtain IV access for the administration of blood, clotting factors, or anticoagulant reversal agents such as protamine sulfate.
- Draw blood to assess Hgb and Hct.

Possible Causes
- Trauma, arterial puncture for procedures, hemophilia, von Willebrand’s disease, thrombocytopenia, disseminated intravascular coagulation (DIC), vascular trauma or iatrogenic arterial injury, anticoagulant therapy, antiplatelet therapy, thrombolytic therapy.

Arterial Occlusion of an Extremity

The Patient May Have . . .
- Numbness, tingling, severe burning pain, or coolness in affected extremity.
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- Loss of sensation in the extremity.
- Pale, mottled, cyanotic, or ashen extremity.
- Edematous, tight, shiny skin over affected extremity.
- Capillary refill >3 sec or absent.

**Immediate Interventions**

**QI** Assess for compartment syndrome, an increase in pressure within a fascial compartment, acute limb ischemia from peripheral artery disease, or complication of arterial puncture, all of which can lead to amputation.

1. **Pain:** patient complains of severe, deep, aching, often burning pain inconsistent with procedure or injury and not relieved by analgesics. Pain is often increased with flexion of the extremity. Pain is an early and important sign.
2. **Paresthesias:** numbness or tingling of extremity—an early but ominous sign.
3. **Pallor:** extremity is paler than other extremities; capillary refill time is prolonged.
4. **Poikilothermia:** affected extremity is cooler than contralateral extremity.
5. **Paralysis:** inability to move extremity as expected and compared with contralateral extremity—late sign suggesting irreversible damage.
6. **Pulselessness:** absence of pulse (check by Doppler)—late sign.

Assess any sites of arterial puncture (e.g., arteriogram puncture site or A-line insertion site) for swelling or hematoma.

**Assess VS.**

If signs and symptoms of compartment syndrome are found, notify physician, PA, or NP STAT and document patient’s status, phone call to provider, and the provider’s response.

**Focused Assessment**

- In addition to above assessment, check all pulses in the affected extremity. Compare with contralateral extremity. Use Doppler amplification if necessary.
- Assess bandages or cast proximal to diminished pulses for tightness.

**Stabilizing and Monitoring**

**QI** Initiation of appropriate interventions depending on cause (cast removal, fasciotomy, limb revascularization, embolectomy), restoration of blood flow.

- Continue to monitor condition of extremity.

**RI** Be alert for worsening signs and notify provider immediately if detected.
Keep extremity at heart level to promote arterial flow without diminishing venous return.

**Be Prepared To**
- Remove any external fixtures (casts) on the extremity or assist the physician, PA, or NP with fasciotomy for immediate relief of pressure.
- Assist with measurement of compartment pressures.
- Prepare the patient for surgery.
- Initiate large-bore IV access.

**Possible Causes**
- Peripheral vascular disease, embolism, endocarditis, mitral stenosis, atrial fibrillation, compartment syndrome, major vascular injury, thrombus, ruptured aortic aneurysm, local or regional block anesthesia, cord injury, lymphedema, fracture, hypotension, hypothermia, dehydration, shock.

## Bradycardia

### The Patient May Have . . .
- HR <60 bpm.
- Nausea and vomiting, dizziness, light-headedness, fatigue.
- Chest pain, SOB, heart failure.
- Hypotension, pulmonary congestion, and/or cyanosis.

### Immediate Interventions
- Assess patient for signs and symptoms (asymptomatic bradycardia may not require treatment). Assess HR of decreased cardiac output and check BP.
- **RI** Notify physician, PA, or NP STAT for SBP <90 mm Hg or HR <40 bpm.
- Have patient sit or lie down in bed; administer supplemental O₂. Obtain a 12-lead ECG (with order); check for ventricular dysrhythmias.
- Check for patent IV access.
- **RI** Document patient’s status; phone call to physician, PA, or NP; and provider’s response or treatment plan.

### Focused Assessment
- Assess LOC and orientation.
- Reassess BP and HR.
- Assess respirations for rate and effort; assess SaO₂.
- Assess skin color, moistness, and temperature.
Assess for associated symptoms (chest pain, SOB, hypotension).
If patient on telemetry or cardiac monitor, assess ECG.

Stabilizing and Monitoring

- Need for intervention ruled in or out; treatment plan for pacemaker insertion or medication administration established as indicated; relief of symptoms.
- Set up cardiac monitoring, and monitor rate and rhythm.
- Monitor VS and mental status.
- Assess recent laboratory results (cardiac enzymes, electrolytes, digoxin level if prescribed, blood glucose, and others).
- Chart patient status and convey to physician, PA, or NP.

Be Prepared To

- Administer medications as ordered. Emergency medications include atropine, epinephrine, dopamine.
- Obtain or order laboratory tests.
- Titrate O₂ to keep SaO₂ >90%.
- Obtain IV access if none available.
- Assist with external pacing.
- Transfer patient to intensive care unit (ICU) or telemetry unit.

Possible Causes

- Medication toxicity, vasovagal response, hyperkalemia, hypothermia, hypothyroidism, sepsis, severe infection, hypoglycemia, hypothermia, excellent physical condition (athletes), myocardial infarction, shock.

Chest Pain (Unstable Angina; Acute Coronary Syndrome, Acute MI)

The Patient May Have . . .

- Typical angina: Substernal pain provoked by activity or emotion and relieved by rest and/or NTG.¹
- Atypical angina: pain or discomfort that radiates to left neck, jaw, back, and/or one or both arms and has two or three of the features of typical angina.¹
- Nonanginal chest pain: has one or none of the features of typical angina.¹

**Cardiac**

- **High-risk symptoms**: severe or ongoing pain, pain lasting >20 min, new pain at rest or with minimal activity, severe dyspnea, loss of consciousness.\(^1\)
- Marked anxiety, expression of “impending doom.”
- Cool, pale, and/or diaphoretic skin.
- Nausea, vomiting.
- SOB, tachypnea.
- Dizziness, fatigue, fainting.

**Immediate Interventions**

- Assess VS; assess whether chest pain is new onset with minimal activity or occurred at rest.
- Assess LOC.

\(\text{QI}\) Administer high-flow O\(_2\) by nonrebreather mask (10–15 L/min) or by nasal cannula (4–6 L/min). Keep SaO\(_2\) >90%\(^1\)

\(\text{QI}\) \(\text{RI}\) Obtain ECG and initiate cardiac monitoring.

- \(\text{QI}\) Administer medications for cardiac symptoms: NTG 0.4 mg SL (hold for BP <90 mm Hg); morphine 2 mg IV (hold for RR <8, BP <90 mm Hg); chewable aspirin (ASA) 162–325 mg PO.

- Check for IV access. Prepare to initiate saline lock IV access.

\(\text{RI}\) Notify physician, PA, or NP and document provider’s response.

- Elevate head of bed (HOB) to facilitate breathing.
- Document patient’s status; phone call to physician, PA, or NP; and provider’s response.

**Focused Assessment**

- Assess HR, rhythm, BP, respiratory rate and effort every 5 to 15 minutes, as indicated.
- Assess skin color, temperature, and moisture (detect early signs of shock).
- Assess SaO\(_2\) with pulse oximetry.
- Assess ECG for ST-segment elevation >1 mm in two or more limb leads or ≥2 mm in chest leads indicate acute MI. Likewise, assess for a left bundle branch block, which may indicate acute MI.\(^1\)
- Auscultate lung fields.

**Stabilizing and Monitoring**

\(\text{QI}\) Determine likelihood of acute cardiac ischemia, obtain ECG with 10 mins of pain onset, initiate treatment.

- Evaluate response to medications (decreased pain, improved SaO\(_2\), decreased anxiety).

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Identify underlying rhythm.
- Obtain cardiac enzymes/troponin levels.
- Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**
- Assess need and eligibility for thrombolytic therapy.
- Administer oral or IV medications.
- Obtain additional laboratory tests (electrolytes, prothrombin time [PT], partial thromboplastin time [PTT], cardiac markers).
- Transfer patient to ICU or send to cardiac catheterization laboratory.

**RI** Call a code; perform cardiopulmonary resuscitation.

**QI** Initiate statin therapy.

**Possible Causes**
- Angina, anxiety, MI, pulmonary embolism (PE), pulmonary edema, chest trauma, endocarditis, pericarditis, indigestion, gastroesophageal reflux disorder (GERD), pleurisy, bronchitis.

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**Chest Pain (Nonspecific or Unknown Cause)**

**The Patient May Have . . .**
- Substernal or epigastric sensations of fullness, pressure, or tightness.
- Pain with inspiration or coughing or chronic cough.
- Diffuse chest pain, rib tenderness.
- Pain after meals.
- Sudden sharp pain or dull pain.

**Immediate Interventions**
- Elevate head of bed to relieve reflux symptoms and facilitate breathing.
- Assess VS, character and quality of pain, time of onset and what precipitated it, whether the pain is new, and if not new, whether it is worse.
- Assess for any red flag symptoms such as change in LOC, other signs of poor perfusion, hypotension, or SOB. **RI** If accompanied by red flag symptoms, notify physician, PA, or NP and ask if provider wants a STAT ECG or medications.
- Document patient’s status; call to physician, PA, or NP; and provider’s response.

**Focused Assessment**
- Continue assessment to determine cause (see Causes of Chest Pain table, p 19).
Assess associated signs and symptoms (e.g., fever, cough, fatigue).
Assess for signs or symptoms that suggest a gastrointestinal (GI) or musculoskeletal cause.
Assess for signs of deep vein thrombosis/phlebitis, which could indicate a possible PE.
Inspect chest for rash (suggests herpes or shingles) or abnormal or asymmetric movements.
Gently palpate rib-sternal cartilage for tenderness.
Ask about recent food or beverage intake.
Auscultate lung fields; assess pulse oximetry.
Assess history of anxiety and/or panic attacks.

**Stabilizing and Monitoring**

**OI**  *Identification of cause for pain. Initiation of appropriate treatment.*

**SI**  If pain suggests an urgent problem such as PE or MI, stay with patient continually, reassess frequently, and initiate any interventions immediately.
Administer ordered medications and assess response.
Identify any emerging problems.
Obtain laboratory tests, ECG, or chest x-ray, if ordered.
Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**

Start anticoagulant therapy if PE is ruled in or strongly suspected.
Set up or change the O2 delivery system.
Administer oral or IV medications.
Obtain laboratory tests (electrolytes, PT, PTT, cardiac markers).
Transfer patient to ICU.

**Possible Causes**

Angina, anxiety, MI, PE, pulmonary edema, chest trauma, endocarditis, pericarditis, indigestion, GERD, pleurisy, bronchitis, musculoskeletal problem.
# Causes of Chest Pain

<table>
<thead>
<tr>
<th>Cause</th>
<th>Pain Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial ischemia (acute MI/angina)</td>
<td>Acute, crushing pain radiating to the jaw or arm. Pain on exertion relieved by rest (angina).</td>
</tr>
<tr>
<td>Thoracic aortic dissection</td>
<td>Sudden, tearing pain radiating to the back. Syncope, stroke, or leg ischemia.</td>
</tr>
<tr>
<td>Pericarditis</td>
<td>Constant or intermittent sharp pain aggravated by breathing, swallowing food, or supine position and relieved by sitting leaning forward.</td>
</tr>
<tr>
<td>Esophageal rupture</td>
<td>Sudden, severe pain after vomiting or instrumentation (e.g., endoscopy).</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>Pain in the epigastrium or lower chest.</td>
</tr>
<tr>
<td>Peptic ulcer</td>
<td>Recurrent, vague epigastric or right upper quadrant discomfort relieved by food, antacids, or both.</td>
</tr>
<tr>
<td>Esophageal reflux disease</td>
<td>Burning pain radiating from epigastrium to throat; worsened by lying down; relieved by antacids.</td>
</tr>
<tr>
<td>Biliary tract disease</td>
<td>Recurrent right upper quadrant or epigastric after meals. May radiate to back.</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>Pleuritic chest pain with acute dyspnea.</td>
</tr>
<tr>
<td>Pleuritis</td>
<td>Pain with inspiration, expiration, or coughing.</td>
</tr>
<tr>
<td>Musculoskeletal chest wall pain</td>
<td>Tenderness typically occurring for days or longer, worse with palpation or active motion.</td>
</tr>
<tr>
<td>Herpes zoster infection</td>
<td>Sharp, bandlike pain midthorax unilaterally. Classic linear, vesicular rash. Pain may precede rash by several days.</td>
</tr>
</tbody>
</table>
Heart Failure

The Patient May Have . . .
- SOB, orthopnea, dyspnea, adventitious breath sounds (rales or crackles), cyanosis.
- Change in mental status, anxiety, restlessness, confusion.
- Edema, jugular vein distention, increased central venous pressure, positive fluid balance.
- Fatigue, weakness.

Immediate Interventions
- Assess VS; note if hypotensive.
- Elevate HOB and lower legs.
- Administer supplemental O₂ (100% nonrebreather mask).
- Restrict fluids.
- Assess for patent IV.
- Notify physician, PA, or NP and document provider’s response.

Focused Assessment
- Assess airway, RR and effort, BP, and HR.
- Auscultate lung fields for pulmonary congestion (crackles, wheezes).
- Assess SaO₂ via pulse oximetry.
- Assess LOC and orientation.
- Assess cardiac rhythm.
- Ask about or check chart for advance directive.

Stabilizing and Monitoring
- Relief of acute symptoms, treatment of life-threatening and/or precipitating conditions, correction of blood pressure and fluid volume.
- Restrict fluids, and administer diuretics and/or vasodilators as ordered.
- Closely monitor I&O.
- Assess for improvement of LOC and oxygenation status.

Be Prepared To
- Titrate O₂ to keep SaO₂ >90%.
- Obtain IV access.
- Set up cardiac monitoring.
- Administer oral or IV diuretics, NTG, morphine, and electrolytes as ordered.
- Initiate beta blocker therapy (bisoprolol, carvedilol, or sustained-release metoprolol) for patients with left ventricular systolic dysfunction evidenced by ejection fractions <40%.
- Order a chest x-ray and ECG.
Order or obtain laboratory tests (BUN, creatinine, complete blood count, electrolytes).
Transfer patient to ICU or telemetry unit.

Possible Causes
- Atrial fibrillation, marked bradycardia, systemic infection, septic shock, PE; stress; cardiac infection and inflammation; excessive intake of water and/or sodium; administration of cardiac depressants or drugs (causes salt retention); cardiomyopathy, hypertension, severe aortic stenosis, ischemic myocardial disease, coronary artery disease, acute mitral or aortic regurgitation, infective endocarditis with acute valve incompetence, MI, anemia, hyperthyroidism, pregnancy, glomerulonephritis, cor pulmonale, polycythemia vera, carcinoid syndrome, obesity.

Hemorrhage

The Patient May Have . . .
- Increased HR to severe tachycardia; hypotension; narrow pulse pressure; delayed capillary refill (>3 sec); cool extremities; and pale, mottled, or cyanotic skin.
- Slightly elevated RR to severe tachypnea.
- Thirst.
- External hemorrhage involves loss of blood from a traumatic wound or in a wound drainage system.
- Internal bleeding can cause rectal or vaginal bleeding, hematuria, hematemesis, hemoptysis, saturated postoperative dressings, or excessive bloody drainage in a wound drainage system.
- Internal hemorrhage is suggested by abdominal pain and distention; sudden chest and/or back pain, bruising around umbilicus or flanks, or peri-incisional swelling and hematoma.
- Intracranial bleeding is suggested by subtle changes in LOC such as anxiety, irritability, restlessness, decreased alertness (early CNS signs of blood loss), confusion, combativeness, changes in pupil size and responsiveness, lethargy, coma (later CNS signs).

Immediate Interventions
- Get help and notify surgeon, physician, PA, or NP. Ask about inserting an IV and starting normal saline if bleeding is severe and there is no IV access.
Have the patient lie down; elevate the feet about 12 inches.
- Discontinue thrombolytics or anticoagulants.
- Control external bleeding with direct pressure.
- Do not remove saturated dressings because this may also remove a clot; reinforce with additional dressing and pressure.
- Administer supplemental O₂; maintain patent airway.
- Assess LOC, BP, and HR.
- Document patient’s status; phone call to physician, PA, or NP; and provider’s response.

**Focused Assessment**
- Assess LOC, orientation, and VS. Assess for signs of impending shock (see table, p 23).
- Assess SaO₂ via pulse oximetry if available. *(Note: may be unreliable due to decreased peripheral perfusion.)*
- Assess skin color, temperature, moistness, turgor, capillary refill.

**Stabilizing and Monitoring**
- Hemostasis of wound, initiation of fluid resuscitation as indicated, initiation of appropriate procedures such as surgery.
- Monitor VS and oxygenation status.
- If patient previously typed and crossmatched, call blood bank to see if any blood is available.
- Monitor output from Hemovac, JP drains, nasogastric tube, and urinary catheter.
- Check Hgb, Hct, and coagulation tests.
- Provide emotional support to patient/family.
- Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**
- Assist with insertion of a central line.
- Obtain laboratory tests (Hgb/Hct, ABGs, electrolytes, blood type, and crossmatch).
- Prepare the patient for surgery.
- Administer colloidal infusions.
- Insert Foley catheter.
- Administer blood.
- Mechanically ventilate.

**Possible Causes**
- External bleeding: wounds (postsurgical and traumatic); internal bleeding: blunt trauma, cancer, ruptured aneurysm, postsurgical, GI perforation, thrombolytic therapy.
## Hemorrhage Severity Classes

<table>
<thead>
<tr>
<th>Hemorrhage Class</th>
<th>Percentage of Blood Loss</th>
<th>Effects</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Up to 15%</td>
<td>No change in vital signs.</td>
<td>No intervention.</td>
</tr>
<tr>
<td>Class II</td>
<td>15%–30%</td>
<td>Tachycardia, narrowing of pulse pressure, peripheral vasoconstriction. Skin may be cool to the touch. Slight changes in behavior.</td>
<td>Fluid resuscitation with normal saline or lactated Ringer’s. Blood transfusion usually not required.</td>
</tr>
<tr>
<td>Class III</td>
<td>30%–40%</td>
<td>Tachycardia, drop in BP. Decreased capillary refill time indicates peripheral hypoperfusion. Changes in mental status.</td>
<td>Fluid resuscitation with normal saline or lactated Ringer’s and blood transfusion usually are necessary.</td>
</tr>
<tr>
<td>Class IV</td>
<td>&gt;40%</td>
<td>Signs and symptoms of hypovolemic shock.</td>
<td>Aggressive resuscitation is required to prevent death.</td>
</tr>
</tbody>
</table>
Hypertensive Crisis

**Hypertensive Urgency:** sudden spike in blood pressure with SBP >180 mm Hg or DBP >140 mm Hg.

**Hypertensive Emergency:** SBP >200 mm Hg or DBP >120 mm Hg with evidence of acute end-organ damage.

**The Patient May Have . . .**
- Headache, restlessness, confusion, visual disturbances, seizure.
- Dyspnea, tachycardia, bradycardia, pedal edema, chest pain.
- Fatigue, light-headedness, dizziness.
- Nausea, vomiting, diaphoresis.

**Immediate Interventions**
- Assess BP in both arms.
- Elevate HOB to 30°–45°.
- Notify physician, PA, or NP and document patient's status, phone call, and provider's response.

**Focused Assessment**
- Assess LOC and orientation.
- Assess respiratory status.
- Assess for neurological deficits (hemiparesis, slurred speech).
- Assess baseline VS (temperature, HR, RR, BP).
- Assess for associated symptoms: visual disturbances, chest pain, peripheral edema, hematuria.

**Stabilizing and Monitoring**
- Blood pressure stabilizes and returns to acceptable range, additional antihypertensive medications are initiated as indicated.
- Maintain continuous monitoring of BP and HR.
- Assess for changes in cardiac rhythm if patient is on a monitor.
- Monitor I&O.
- Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**
- Titrate O₂ to SaO₂ >90%.
- Obtain a saline lock IV access.
- Administer ordered antihypertensive medications (oral or IV).
- Obtain or order laboratory tests (BUN, creatinine, electrolytes, urinalysis).
- Assist with arterial line placement.
- Transfer patient to ICU.

**Possible Causes**
- Atherosclerosis, primary hypertension, stress, anxiety, anger, medication, stroke, toxemia of pregnancy, diabetes, cardiac or renal disease, drugs (amphetamine, cocaine, corticosteroids, oral contraceptives).
## Treatment for Hypertensive Crisis

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>The Patient May Have . . .</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>180/110 not sudden onset with mild or no symptoms</td>
<td>General headache or occipital headache in the morning</td>
<td>Initiate medication or increase dose of existing medications. Monitor for 1–3 hr until BP reaches acceptable range.</td>
</tr>
<tr>
<td><strong>Urgency:</strong> &gt;180/110 with obvious symptoms</td>
<td>Severe headache, shortness of breath</td>
<td>Initiate medication or increase dose of existing medications. Monitor for 3–6 hr. Goal: lower MAP by 25% in 24 hr.*</td>
</tr>
<tr>
<td><strong>Emergency:</strong> &gt;220/140</td>
<td>Shortness of breath, chest pain, weakness, altered LOC, pulmonary edema, renal insufficiency, cerebrovascular accident, cardiac ischemia, aortic aneurysm</td>
<td>Start IV; IV vasoactive drugs cannot be given without ICU level of care. Physician may administer IV medications before transfer to ICU if portable monitoring available. Monitor BP continuously. Goal: lower MAP by 10% in 1 hr and 15% in next 2–3 hr.*</td>
</tr>
</tbody>
</table>

*Avoid a too-rapid drop in blood pressure to prevent cardiac or cerebral hypoperfusion.
Hypotension

The Patient May Have . . .
- SBP < 90 mm Hg or SBP 40 mm Hg less than baseline.
- Cool, pale, ashen, cyanotic, diaphoretic skin.
- Altered LOC or orientation, blurry vision, syncope.
- SOB, dyspnea.
- Nausea and vomiting.
- Tachycardia or bradycardia.

Immediate Interventions
- Place patient in a supine position with legs elevated above heart level to increase circulation to vital organs. **Note:** This position is contraindicated if the airway is compromised; to maintain airway patency, place patient in supine or low Fowler’s position (HOB slightly elevated).
- Recheck BP after 1–2 minutes. If it has returned to baseline and the patient is comfortable, assess for orthostatic hypotension (see below).
- **RI** If BP is lower or patient is pale, disoriented, or loses consciousness, call for emergency assistance.
- **RI** If you cannot get a blood pressure, call a CODE.
- **RI** If respiratory effort inadequate (RR < 8, cyanosis, Sao₂ < 90%), administer high-flow O₂ via mask (10–15 L/min), or manually assist ventilations with an Ambu bag (mask-valve device).
- Control bleeding, if any, with direct pressure.
- Check for patent IV access.
- Notify physician, PA, or NP.
- Document patient’s status, phone call to physician, PA, or NP, and physician, PA, or NP response.

Focused Assessment
- Assess LOC, orientation, baseline VS (temperature, HR, RR, BP), and pulse quality and rhythm.
- Assess respiratory effort and airway patency.
- Assess skin color, temperature, moistness, turgor, and capillary refill.
- Assess for associated symptoms (chest pain, dyspnea, nausea).
- Assess I&O; ask patient about recent history of vomiting, diarrhea, or urinary symptoms (burning, frequency, flank pain, hematuria, which could suggest urosepsis).
- Assess MAR for medications that can affect blood pressure.
Assess for orthostatic hypotension by having patient stand. Immediately check BP. If it drops >20 mm Hg systolic or 10 mm Hg diastolic, the patient has orthostatic hypotension. Protect patient from falling.

**Stabilizing and Monitoring**

Blood pressure stabilizes and returns to acceptable range; patient is protected from injury during hypotensive episode and associated light-headedness; cause is identified and addressed.

- Assess for possible causes such as dehydration, infection, allergic reaction, blood loss from recent surgery, bradycardia, and medications (diuretics, blood pressure medications, erectile dysfunction medications, and others).
- Continue to monitor VS.
- Review laboratory data (Hgb/Hct, BUN, urine specific gravity, electrolytes).
- Evaluate previous 24-hr I&O.
- Check MAR for possible medication-induced hypotension.
- Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**

- Titrate O₂ to SaO₂ of 90%.
- Obtain IV access, and administer ordered IVF.
- Administer ordered vasoactive medications.
- Order specific laboratory tests to be drawn
- Transfer patient to a critical care unit.

**Possible Causes**

- Medication, dehydration, hemorrhage, vasovagal response to anxiety, sepsis, shock, GI bleed or other internal bleeding, aneurysm, congestive heart failure, cardiac dysrhythmias, myxedema, adrenal crisis, hypoglycemia, completed stroke.

---

**Syncope**

**The Patient May Have . . .**

- Light-headedness.
- Rapid breathing (hyperventilation).
- Nausea, vomiting.
- Cool, pale, diaphoretic skin.
Immediate Interventions

- Assist patient to chair or bed (or floor if necessary).
- Administer supplemental O₂ via nasal cannula.
- Assess rate, ease of breathing.
- Assess BP.
- Assess HR, rhythm, and quality.
- If patient is hypotensive, keep supine, and elevate lower legs about 12 inches using pillows.
- Notify physician, PA, or NP.
- Document patient’s status, phone call to provider, and provider’s response.

Focused Assessment

- Assess airway patency and patient’s breathing.
- Assess LOC and mental status; determine whether patient had a sensation of spinning or movement.
- Assess for associated neurological signs (slurred speech, numbness, weakness).
- Assess skin for color, temperature, turgor, and moistness.
- Ask whether patient feels nauseated or is experiencing chest pain.
- Check recent chemistry and hematology laboratory results.
- Check whether new medications have been administered.
- Review I&O records from preceding days.

Stabilizing and Monitoring

- Resolution of syncopal episode; identification of cause (see Possible Cause of Syncope table) and initiation of treatment as indicated.
- Assess orthostatic VS: take HR and BP in supine, sitting, and standing positions, each 2 min apart. Note if pulse increases by ≥20 bpm and the systolic BP drops by ≥20 mm Hg, which suggests hypovolemia or dehydration.
- Assess mucous membranes and skin turgor for signs of dehydration.
- Continue to assess VS as frequently as indicated.
- Review history and all current medications.
- Test stool for occult blood.
- Chart patient status and convey to physician, PA, or NP.

Be Prepared To

- Obtain IV access.
- Administer IVF or a fluid challenge.
- Obtain a Chemstick blood sugar level; administer 50% dextrose IV if blood glucose level is low.
- Order specific laboratory tests to be drawn.
Possible Causes

- Dysrhythmias, cardiac insufficiency, anemia, hypoxia, orthostatic/postural hypotension, hypovolemia/dehydration, hypertension, medication reaction, electrolyte imbalance, hypoglycemia, hyperglycemia, concussion, vasovagal response, stress/anxiety/fear.

<table>
<thead>
<tr>
<th>Source</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Bradycardia (HR &lt;60 bpm). Tachycardia (HR &gt;100 bpm). Dysrhythmias. Decreased cardiac output. Hemorrhage. Aortic or pulmonic stenosis. Pulmonary hypertension.</td>
</tr>
<tr>
<td>Neurological</td>
<td>Seizure, head trauma.</td>
</tr>
<tr>
<td>Vascular</td>
<td>Vasovagal or postural hypotension. Transient ischemic attack, stroke.</td>
</tr>
<tr>
<td>Other</td>
<td>Hyperventilation, anxiety, hypoxia.</td>
</tr>
</tbody>
</table>

Tachycardia

The Patient May Have . . .

- HR 100–150 bpm (sinus tachycardia—may be asymptomatic); HR >150 bpm (supraventricular tachycardia).
- Palpitations, dizziness, or light-headedness.
- Chest discomfort, SOB, anxiety, restlessness, altered LOC.
- Signs of unstable tachycardia:
  - Hypotension.
  - Pulmonary congestion and/or cyanosis.
Immediate Interventions

- Have patient sit or lie in bed.
- Assess blood pressure and respirations.
- Administer supplemental O₂.
- Reduce or eliminate environmental stressors.
- Notify physician, PA, or NP.
- Document patient’s status, phone call to provider, and provider’s response.

Focused Assessment

- Assess LOC, orientation, and VS (temperature, HR, RR, BP).
- Assess SaO₂ via pulse oximetry, if available.
- Assess heart rhythm.
- Assess skin for color, turgor, moistness, and temperature.
- Assess for associated symptoms (body pain, chest pain, SOB, hypotension, fever, dehydration).
- If patient on telemetry or cardiac monitor, assess rhythm strip.

Stabilizing and Monitoring

- Cause of tachycardia is identified and treated.
- Assess HR, BP, and SaO₂ as needed until stable.
- Assess 12-lead ECG (see rhythm strip examples in this tab for help).
- Assess recent history of emotional upset, medication use, disease, vomiting, blood loss from menses, GI pain or nausea, melanotic stool.
- Assess MAR for medications with potential to cause tachycardia.
- Assess blood glucose level.
- Assess recent I&O.
- Chart patient status and convey to physician, PA, or NP.

Be Prepared To

- Set up cardiac monitoring; order 12-lead ECG.
- Titrate O₂ to keep SaO₂ >90%.
- Obtain IV access.
- Administer oral or IV medications as ordered.
- Order laboratory tests to be drawn.
- Assist with cardioversion.
- Transfer patient to the cardiac care or telemetry unit.

Possible Causes

- Hypoxia, exercise, caffeine, fever, medications, pain, anxiety, stress, atrial fibrillation, infection, hypoglycemia, hemorrhage, hypovolemia, dehydration, electrolyte imbalance.
IV solutions can be divided into two basic categories: crystalloids and colloids (volume expanders). Crystalloids contain water, dextrose, and/or electrolytes and are commonly used to treat different fluid and electrolyte imbalances. Colloids (also called plasma expanders or volume expanders) have a greater osmotic pressure than crystalloids; they remain in intravascular space longer and are used for volume expansion.

### Crystalloid IV Solutions

<table>
<thead>
<tr>
<th>Type of Solution</th>
<th>Components</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Saline solutions</strong></td>
<td>Sodium and chloride</td>
<td>Alkalosis. Sodium depletion. Fluid loss.</td>
</tr>
<tr>
<td>0.9% NaCl, 0.45% NaCl,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.25% NaCl</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dextrose solutions</strong></td>
<td>Dextrose in water</td>
<td>Replace calories as carbohydrates. Prevent dehydration.</td>
</tr>
<tr>
<td>D$<em>5$W, D$</em>{10}$W</td>
<td></td>
<td>Maintain water balance. Promote sodium diuresis.</td>
</tr>
<tr>
<td><strong>Dextrose and saline</strong></td>
<td>Dextrose in saline</td>
<td>Promote diuresis. Prevent alkalosis. Correct moderate fluid loss. Provide calories and sodium chloride.</td>
</tr>
<tr>
<td>mixtures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D$_5$NS, D$_5$ 0.45% NS,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D$_{10}$NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Multielectrolyte</strong></td>
<td>Combination of Na, Cl, K,</td>
<td>Replaces fluid lost due to vomiting or GI suctioning.</td>
</tr>
<tr>
<td>solutions**</td>
<td>Ca, and lactate</td>
<td>Treats dehydration. Restores normal fluid balance.</td>
</tr>
<tr>
<td>Ringer's lactate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Volume expanders include colloids, dextran, and hetastarch. Colloids are protein solutions such as albumin, plasma, and commercial plasmas (e.g., Plasmanate). Dextran is a complex, synthetic sugar. Because Dextran is slowly metabolized, it does not stay in the vascular space as long as a colloid. Hetastarch is a synthetic colloid that works similarly to Dextran.

### Colloid Volume Expanders

<table>
<thead>
<tr>
<th>Type of Solution</th>
<th>Components</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% Albumin</td>
<td>Human plasma protein</td>
<td>Rapid volume expansion and mobilize interstitial edema.</td>
</tr>
<tr>
<td>25% Albumin</td>
<td>Human plasma protein</td>
<td>Pull interstitial fluid back into circulating volume.</td>
</tr>
<tr>
<td>Hetastarch</td>
<td>Synthetic colloid similar to 5% albumin</td>
<td>Volume expansion. Mobilize interstitial edema.</td>
</tr>
</tbody>
</table>

### Blood Transfusion Tips and Reminders

- You must know the blood type and Rh classification of the patient to ensure blood compatibility.
- Patients with type AB blood are “universal recipients.”
- Patients with Rh-positive blood can receive Rh-positive or Rh-negative blood, but those with Rh-negative blood can receive only Rh-negative blood.
- Type O, Rh-negative blood is the “universal donor.”
Patients with a history of transfusion reactions should be premedicated with acetaminophen (Tylenol) and diphenhydramine (Benadryl) to reduce the likelihood of a febrile or allergic response.

Normal saline is the only solution compatible with blood; other solutions will cause hemolysis.

Follow your facility’s policy and procedure exactly to ensure that you pick up the right blood product from the blood bank.

Any discrepancy must be investigated and resolved before the blood product can be administered.

The transfusion must begin within 30 minutes of the blood being released from the blood bank.

Take a set of VS before spiking the blood bag. If there are any abnormal results, especially a temperature elevation, notify the physician, PA, or NP. The transfusion may be withheld. A preexisting fever can obscure the development of an acute transfusion reaction.

Follow your facility’s policy and procedure for verifying that the blood product matches the patient’s unique identifiers.

Start the transfusion slowly—approximately 15 drops per minute.

Most transfusion reactions occur within the first 15 minutes; usually, the more blood transfused, the worse the reaction.

Take another set of VS after the first 15 minutes. If there is no change from the first set, the rate can be increased so that the remaining amount infuses in the appropriate time frame.

Take VS every hour and after the transfusion is complete.

If there is a change in vital signs, particularly a temperature elevation, or if the patient begins to experience any unusual symptoms, STOP THE TRANSFUSION AND NOTIFY THE PHYSICIAN. Stay with the patient, and reassess VS as indicated.

Disconnect the transfusion set but keep the IV line open with normal saline to provide access for possible IV drugs.

Send the blood bag and tubing to the blood bank.

Draw a blood sample for plasma Hgb, culture, and retyping.

Collect a urine sample as soon as possible for Hgb determination.

Be prepared to initiate emergency interventions until the type and severity of the reaction is established.
<table>
<thead>
<tr>
<th>Blood Product</th>
<th>Indications/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whole blood.</strong>&lt;br&gt;Contains all blood products.&lt;br&gt;Must be ABO and Rh identical.</td>
<td>Rarely used; may be given to an exsanguinating patient.</td>
</tr>
<tr>
<td><strong>Packed red blood cells (PRBCs).</strong>&lt;br&gt;No clotting factors or platelets, 80% plasma removed.&lt;br&gt;Must be ABO and Rh identical.</td>
<td>Increase oxygen carrying capacity.&lt;br&gt;Hgb &lt;6 g/dL or &lt;10 g/dL if there is organ ischemia.&lt;br&gt;Anemia that cannot be treated with other therapies.&lt;br&gt;May have leukocytes removed (called “leukocyte poor”) to prevent febrile reaction.</td>
</tr>
<tr>
<td><strong>Platelets.</strong> Platelets only.&lt;br&gt;Should be ABO and Rh identical.</td>
<td>Prevent bleeding related to low platelet counts or coagulopathies.&lt;br&gt;One unit may increase platelet count by 6,000 units.&lt;br&gt;Should not be given to patients with autoimmune thrombocytopenia or thrombocytopenic purpura except in life-threatening hemorrhage.&lt;br&gt;May be HLA (human leukocyte antigen) matched or unmatched.</td>
</tr>
<tr>
<td><strong>Fresh frozen plasma.</strong>&lt;br&gt;Plasma and clotting factors.&lt;br&gt;Should be ABO identical.</td>
<td>To replace clotting factors after multiple transfusions (≥6 PRBCs); Coumadin intoxication; replace clotting factors.&lt;br&gt;Should not be given to correct coagulopathy that can be treated with vitamin K.</td>
</tr>
<tr>
<td><strong>Cryoprecipitate.</strong> Clotting factors and fibrinogen.&lt;br&gt;ABO compatibility preferred.</td>
<td>Bleeding related to hemophilia, fibrinogen deficiency, DIC.</td>
</tr>
<tr>
<td><strong>Factor IX concentrate.</strong></td>
<td>Treatment of hemophilia B; carries a high risk of hepatitis because it requires pooling from many donors.</td>
</tr>
<tr>
<td><strong>Factor VIII concentrate.</strong></td>
<td>Treatment of hemophilia A; heat-treated product decreases the risk of hepatitis and HIV transmission.</td>
</tr>
</tbody>
</table>
### Transfusion Times

<table>
<thead>
<tr>
<th>Blood Product</th>
<th>Transfusion Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed RBCs</td>
<td>Maximum of 4 hr, 2–3 hr if tolerated</td>
</tr>
<tr>
<td>Platelets</td>
<td>As rapidly as tolerated (4 units every 30–60 min).</td>
</tr>
<tr>
<td>FFP</td>
<td>As rapidly as tolerated</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>Transfuse at 4–10 mL/min</td>
</tr>
</tbody>
</table>

### Transfusion Reactions

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Signs and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute hemolytic reaction</strong>—clumping of blood in the circulation</td>
<td>Fever, chills, rigors, itching, flushing, chest pain, respiratory distress, restlessness, anxiety, nausea, hypotension or hypertension, tachycardia, shock. Severity correlates to the amount of blood transfused.</td>
</tr>
<tr>
<td>Febrile nonhemolytic reaction</td>
<td>Fever, chills, rigors, no respiratory distress or hypotension, shock.</td>
</tr>
<tr>
<td>Contamination</td>
<td>Fever, chills, rigors, SOB, hypotension.</td>
</tr>
<tr>
<td>Circulatory overload</td>
<td>SOB, hypertension.</td>
</tr>
<tr>
<td><strong>Acute lung injury</strong></td>
<td>Respiratory distress, cyanosis, hypoxemia (O2 sat ≤90%), hypotension or hypertension, fever, tachycardia.</td>
</tr>
<tr>
<td><strong>Allergic reaction</strong></td>
<td>Wheezing, stridor, dyspnea, throat tightness, cyanosis, hives, itching, flushing, hypotension, GI distress, shock, loss of consciousness, cardiac arrest (rare).</td>
</tr>
</tbody>
</table>
### Treatment for Specific Reactions

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute hemolytic reaction</td>
<td>Admit to ICU for treatment of hypotension, DIC, renal failure.</td>
</tr>
<tr>
<td>Febrile, nonhemolytic reactions</td>
<td>Antipyretics; leukocyte-poor blood products and premedication with acetaminophen and diphenhydramine for subsequent transfusions.</td>
</tr>
<tr>
<td>Septic reaction</td>
<td>Blood cultures, antibiotics, fluids, steroids, vasopressors.</td>
</tr>
<tr>
<td>Allergic reactions</td>
<td>Antihistamines, aminophylline, steroids, epinephrine as indicated by severity.</td>
</tr>
<tr>
<td>Circulatory overload</td>
<td>IV diuretics and O₂.</td>
</tr>
<tr>
<td>Lung injury</td>
<td>Oxygen, ventilator support, fluids, vasopressors.</td>
</tr>
</tbody>
</table>

### ANALYZING RHYTHM STRIPS

**Standard Placement: Lead-II AND Five Wire**

- **White's** on the right (negative)
- **Smoke** (Ground) Over
- **Fire** (positive)

Chest lead and Right leg lead included for seven channel monitoring and...

Standard placement: Lead II is standard. A five-wire monitor may be used in ICUs to monitor more leads.
Rhythm Strip Tips

- Make sure leads are in the correct position. Incorrectly placed leads give a distorted reading.
- Place electrodes on wires before placing electrodes on the patient to prevent applying uncomfortable pressure on the patient’s chest.
- Use the rough patch on the electrode to remove dead skin cells.
- Shave patients who are extremely hairy.
- Clean the areas with alcohol and allow to dry to get a good contact.
- If the patient is diaphoretic, use tincture of benzoin to help the electrode adhere.
- Do not place leads over boney areas.
- Place electrodes under the female breast.
- Replace electrodes if the rhythm strip quality is poor. The gel may have dried out.
- Observe rhythm on monitor and compare to apical pulse to make sure display is accurate.
- Set upper and lower limits per hospital policy.

Cardiac structure and blood flow.
Rapid Respiratory Assessment

A focused assessment of respiratory status includes evaluation of:
- Ease of breathing and respiratory rate (RR).
- Lung sounds.
- Use of O2 and oxygenation.
- Arterial blood gas (ABG) interpretation if needed.
- Ventilator assessment, if applicable.
- Mental status markers, such as level of alertness, restlessness, confusion, irritability, or stupor.

Assess ease of breathing and RR.
- Ask the patient how he or she is breathing; use his or her subjective terminology when documenting, as in “feels like he can’t catch his breath.”
- Ask if shortness of breath (SOB) is triggered by activity and if rest relieves the feeling.
- Ask about energy levels and whether the patient can eat and talk comfortably.
- Assess rate—normal rate is 12–20; however, most adults have an RR in the lower end of the range. Rates >20 respirations/min should be investigated. A rate >26 is a real concern unless it is the patient’s baseline.
- Assess use of accessory muscles or nasal flaring, both of which indicate respiratory distress.

Assess lung sounds.
- Listen to lung sounds in all fields. Ask the patient to breathe deeply with his or her mouth open.
- Note adventitious sounds, areas where air movement is not heard, or areas where breath sounds are diminished.

Assess use of O2 and oxygenation.
- Note the amount of O2 ordered and the method of delivery (e.g., 3 L/min via nasal cannula).
- Note whether the patient is wearing the O2 all the time and if the device is correctly applied.
- Check pulse oximetry to assess percentage of oxygen saturation (Sao2): 97%–99% is normal, although 93%–97% may be normal for some patients.
- Always look at the whole picture, not just a single reading. Also, pulse oximetry can be inaccurate in the presence of peripheral vascular disease.
Readings of 90% or less indicate possible need for ventilation support.

Compare trends in $O_2$ saturation to determine whether oxygen therapy is effective.

**Analyze ABG results.**

- ABG analysis allows for assessment of acid-base balance and oxygenation.
- It also tells how well the lungs and kidneys are compensating or responding to treatments.
- $pH$, $Paco_2$, and $HCO_3$ tell about acid-base balance.
- $Pao_2$ and $Sao_2$ indicate oxygenation status.
- Normal values (memorize):

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>$pH$</td>
<td>7.35–7.45</td>
</tr>
<tr>
<td>$Pao_2$</td>
<td>80–100 mm Hg</td>
</tr>
<tr>
<td>$Paco_2$</td>
<td>35–45 mm Hg</td>
</tr>
<tr>
<td>$Sao_2$</td>
<td>95%–100%</td>
</tr>
<tr>
<td>$HCO_3$</td>
<td>21–28 mEq/L</td>
</tr>
<tr>
<td>Base excess</td>
<td>−2 to +2 mEq/L</td>
</tr>
</tbody>
</table>

See detailed explanation of how to interpret ABGs in this tab.

### Aspiration/Choking

**The Patient May Have . . .**

- Sudden onset of coughing, gagging, wheezing, and SOB associated with eating, drinking, or regurgitation.
- His or her hands encircling their neck (universal choking sign).
- Risk factors include decreased level of consciousness (LOC), swallowing problems, advanced age, sedative use, seizure disorder, stroke, not sitting up while eating or drinking.
- In patients with decreased LOC, decreased gag reflex or those on respirators, there may be no obvious sign when aspiration occurs.
- Tachypnea or bradypnea, dyspnea, cyanosis, decreased breath sounds.
- Tachycardia, bradycardia.
Crackles and rhonchi (usually on the right but may be on the left or bilateral), pleuritic chest pain.
- Altered mental status.
- Hoarseness, fever.

**Immediate Interventions**
- Elevate head of bed (HOB) to upright position; help patient to expectorate.
- Provide supplemental oxygen.
- Inspect oropharynx for foreign bodies; clear the airway.
  - **RI** If there is evidence of foreign body obstruction, administer the Heimlich maneuver, chest thrusts, or back blows as appropriate (see Choking Quick Reference in the Emergency tab).
- Notify physician, physician’s assistant (PA), or nurse practitioner (NP).
- Document patient status, phone call to provider, and provider’s response.

**Focused Assessment**
- Assess airway for secretions or foreign objects.
- Assess effectiveness of measures taken to clear airway.
- Assess oxygenation status: LOC, SaO₂, presence of circumoral and nailbed cyanosis.
- Assess heart rate (HR), blood pressure (BP), respirations (rate, rhythm, and effort), work of breathing, and temperature.
- Auscultate lung fields.

**Stabilizing and Monitoring**
- **OI** Clear airway; optimal SaO₂ for patient, antibiotics initiated as indicated; aspiration precautions maintained; speech therapy for swallowing evaluation as needed.
- Continue to monitor airway and respiratory function.
- Consider a speech pathology consultation to assess patient’s level of airway control and/or gag reflexes.
- Monitor patient during oral intake, and assess for evidence of dysphagia.

- **SI** Initiate aspiration precautions:
  - Elevate HOB to upright position during meals, tube feedings, or when taking medications.
  - Maintain upright position for 30 to 45 min after each meal.
  - Encourage patient to take small bites, eat slowly, and chew well.
  - For patients with altered cognition, check mouth for leftover food or medications.
  - Thicken all liquids as per speech pathologist.
**41**

**Be Prepared To**
- Set up and assist with intubation, cricothyrotomy, tracheotomy, or bronchoscopy if indicated.
- Obtain chest radiograph.
- **RI** Call a code.

**Possible Causes**
- Emesis; disorders that affect normal swallowing and gag reflex (depression of the laryngeal reflexes, stroke); disorders of the esophagus (esophageal stricture, gastroesophageal reflux); use of sedative drugs; anesthesia; coma; excessive alcohol consumption; tracheitis; epiglottitis; foreign body aspiration, drug overdose.

---

**Chest Tube Dislodgement**

**The Patient May Have . . .**
- Signs of respiratory distress: rapid, shallow, or increased work of breathing; cyanosis; decreased LOC and SaO₂, restlessness, or anxiety.
- Partially or completely dislodged chest tube.
- Visible chest tube drain pores.
- Whistling sound as air enters or exits wound site or chest tube.

**Immediate Interventions**
- **SI QI RI** Immediately cover chest tube insertion site with sterile petroleum gauze (occlusive dressing) covered with several 4 × 4 pads.
- Administer supplemental O₂ and notify physician, PA, or NP and respiratory therapy (RT) STAT!
- Document patient status, phone call to provider, and provider’s response.

**Focused Assessment**
- Assess LOC, SaO₂, skin color, and work of breathing.
- Assess respirations, auscultate lung fields, and compare chest movements left to right.
- Assess vital signs (VS) and pain level.

**Stabilizing and Monitoring**
- **QI** Replacement of chest tube and reinitiation of drainage/lung expansion; stable and appropriate SaO₂.
- Assist physician with reinsertion of chest tube.
- Ensure CXR is obtained after reinsertion.
Continue to evaluate lung sounds and quality of oxygenation (see additional information about chest tubes on pp 56–60 of this tab).

**SI** Make sure all chest tube connections are secure and that tubing is not tangled or encumbered.

- Maintain drainage system in upright position below heart.

**RI** Place emergency chest tube equipment in patient’s room (sterile normal saline, 4 × 4 pads, petroleum gauze, tape, and nontoothed padded clamps).

- Assess drainage system for proper functioning.

**SI** **QI** Ensure that extra drainage collection system is readily available on the unit.

- Assist patient with movement and repositioning.

**Be Prepared To**

- Set up and assist with reinsertion of chest tube.
- Order portable CXR.
- Administer supplemental O₂.

**Possible Causes**

- Excessive torque or tension on chest tube due to multiple possible causes (chest tubes not hanging freely during movement, improper transfer technique, patient confused).

---

**Dyspnea/SOB**

**The Patient May Have . . .**

- Mild sensation of discomfort to feeling of suffocation.
- Difficulty breathing; inability to take a deep breath.
- Changes in skin color (ashen, pale, or cyanotic); diaphoresis.
- Rapid breathing, wheezing, poor air movement, use of accessory muscles.
- Changes in LOC such as confusion, restlessness, or agitation.

**Immediate Interventions**

- Place patient in a position that facilitates breathing, that is, leaning forward from waist with arms supported on bedside table or thighs.

**SI** Place on pulse oximetry; assess SaO₂ saturation.

**QI** Administer supplemental O₂ at 2 L by nasal cannula if indicated by low SaO₂.

- If patient is hyperventilating, encourage slower, deeper breathing, or, if indicated, have the patient perform pursed-lipped breathing.
Assess VS.
Auscultate lung fields for adventitious sounds and equality of air movement.
Notify physician, PA, or NP.
Difficulty breathing induces fear and panic: stay with patient; maintain calm, reassuring demeanor.
Document patient’s status, phone call to provider, and provider’s response.

**Focused Assessment**
- Continue to assess VS and respiratory status.
- Assess for chest pain, nausea, leg vein tenderness, other cardiovascular symptoms.
- Assess for underlying respiratory conditions such as pneumonia.
- Ask patient about previous episodes of SOB, what provoked it, if onset was sudden or gradual, whether SOB is made worse by lying flat.
- Assess work of breathing as evidenced by flared nostrils, retraction of subclavicular and intercostal spaces, use of accessory muscles, and orthopnea.
- Note tracheal alignment, symmetry of chest expansion, bulging interspaces, and presence of jugular venous distention.
- Assess skin color and moistness, inspect for circumoral and nail bed cyanosis.
- Auscultate lung fields, noting diminished breath sounds, crackles, wheezing, friction rubs, or stridor.
- Assess medication administration record for possible medication/anaphylactic reactions.

**Stabilizing and Monitoring**
- Determine cause of dyspnea/SOB, maintain SaO₂ at optimal level for patient, initiate appropriate treatment.
- Continue to monitor respiratory status as detailed in Focused Assessment, and support effort to breathe.
- Continue to assess patient for contributing factors and underlying cause.
- Administer medications as ordered.
- Chart patient status, and convey to physician, PA, or NP.

**Be Prepared To**
- Obtain IV access.
- Change or set up an O₂ delivery system.
- Assist with diagnostic testing.
Obtain ABGs.
Place a nasal or oral airway.
Suction the oropharynx/trachea.
Administer medication.
Assist with intubation or chest tube placement.
Transfer to intensive care unit (ICU).

Possible Causes
- Allergic reaction, airway obstruction, anxiety/panic attack, aspiration, asthma, cardiac dysrhythmias or tamponade, emphysema, heart failure, cardiac ischemia, pleural effusion/pleuritis, pneumonia, pneumothorax (PTX), pulmonary edema, pulmonary embolism (PE).

Hypoventilation/Ineffective Breathing Pattern

The Patient May Have . . .
- Dyspnea at rest or on exertion.
- Cyanosis of lips and/or nail beds.
- Change in LOC such as lethargy or stupor.
- Shallow, rapid breathing with periods of apnea as in Cheyne-Stokes (neurological).
- Very slow respiratory rate as in possible opioid overdose.
- Signs of right-sided heart failure (JVD, peripheral edema, and hepatomegaly).

Immediate Interventions
- To enhance respiratory effort, attempt to arouse patient with physical stimulation.
- Assess airway for obstruction.
- Perform orotracheal suctioning to clear secretions if indicated.
- Administer supplemental O₂.
- Manually ventilate patient with a bag-valve mask (BVM) device if RR <8 or SaO₂ <90%.
- Get help, notify RT, and call physician, PA, or NP.
- Document patient status, phone call to provider, and provider’s response.

Focused Assessment
- Assess LOC and orientation.
- Assess VS, noting RR, depth, and quality.
- Assess skin color and moistness.
- Auscultate lung fields for adventitious sounds and equality of breath sounds.
Stabilizing and Monitoring

Initiation of appropriate respiratory support, improved SaO₂, increased alertness (if feasible for underlying condition).

Insert oral or nasal airway if necessary. Maintain supplemental oxygen as needed to maintain optimal oxygen saturation.

- Administer bronchodilators if ordered.
- For narcotic/opioid overdose (OD), administer intravenous (IV) Narcan 0.4 mg.
- For IM benzodiazepine OD, administer Romazicon 0.2 mg IV.
- Continue to monitor breathing and oxygenation closely.
- Chart patient ongoing status, and convey to physician, PA, or NP as needed.

Be Prepared To

- Assist with setup and application of appropriate O₂ delivery systems (mask, continuous positive airway pressure [CPAP], bilevel positive airway pressure [BiPAP], intubation/ventilator).
- Obtain IV access.
- Obtain CXR, ABGs, other laboratory tests.
- Administer medication as ordered.
- Transfer to ICU.

Possible Causes

- Chronic obstructive pulmonary disorder (COPD), emphysema, chronic bronchitis, neuromuscular disorders, amyotrophic lateral sclerosis, muscular dystrophy, diaphragm paralysis, Guillain-Barré syndrome, myasthenia gravis, chest wall deformities, kyphoscoliosis, fibrothorax, thoracoplasty, central respiratory drive depression; drugs: narcotics, benzodiazepines, barbiturates; neurological disorders: encephalitis, brainstem disease, trauma; primary alveolar hypoventilation, obesity hypoventilation syndrome.

Pulmonary Embolism

The Patient May Have . . .

- Dyspnea, pleuritic chest pain, tachycardia.
- Anxiety, diaphoresis, syncope, hypotension.
- Wheezing.
- Lower extremity edema; signs and symptoms of thrombophlebitis.

Immediate Interventions

Administer supplemental O₂ as ordered.
- Assess respiratory rate and work of breathing; assess VS.
- Notify physician, PA, or NP.
- Obtain pulse oximetry.
- Place on cardiac monitor if readily available.
- Document patient’s status, phone call to provider and provider’s response.

**Focused Assessment**
- Auscultate lung fields for adventitious sounds and equality of air movement.
- Assess Sao₂, cardiac rhythm, VS.
- Assess for chest pain, leg vein tenderness.
- Assess for history of recent surgery, immobilization, recent deep vein thrombosis, malignancy.

**Stabilizing and Monitoring**
- Initiation of anticoagulant therapy; optimal oxygen saturation; identification of source of embolus and treatment initiated.
- Obtain IV access.
- Continue to assess VS, LOC, respiratory status.
  - Initiate anticoagulant therapy (heparin) as soon as possible. Have second practitioner independently calculate dilutions and infusion pump programming.
- Chart patient status, and convey to physician, PA, or NP.

**Be Prepared To**
- Change or set up an O₂ delivery system.
- Titrate heparin infusion based on PTT results.
- Assist with obtaining diagnostic studies (CXR, ventilation/perfusion scan, computed tomography scan, pulmonary angiogram).
- Obtain ABGs.
- Obtain serial partial thromboplastin time, and titrate heparin infusion.
- Transfer to ICU for high-acuity care or thrombolytic therapy.

**Possible Causes**
- Embolization of thrombi from deep veins of the femur, pelvis, and lower extremities from multiple causes including venous stasis, hypercoagulable states, surgery and trauma, oral contraceptive and estrogen replacement therapy, pregnancy, malignancy.

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**Respiratory Distress/Failure**

**The Patient May Have . . .**
- Dyspnea, excessive work of breathing.
- Cyanosis of skin and mucous membranes.
Anxiety, confusion, restlessness, or somnolence. 
Tachycardia and dysrhythmias (due to hypoxemia and acidosis). 
Decreased O₂ saturation: **Note:** SaO₂ <90% is considered abnormal, and lower levels can represent an unstable respiratory status that requires immediate intervention. However, evaluate SaO₂ in context of the patient’s baseline—some patients with COPD may never have an SaO₂ >88% but are still stable. 
Abnormal ABG results: 
- **Hypoxemic respiratory failure**, characterized by a partial pressure arterial oxygen (PaO₂) <60 mm Hg and a normal or low partial pressure arterial carbon dioxide (PaCO₂), is most common and is caused by any acute disease of the lung (pulmonary edema, pneumonia). 
- **Hypercapnic respiratory failure**, characterized by a PaCO₂ >50 mm Hg, is associated with drug overdose, neuromuscular disease, chest wall abnormalities, and severe airway disorders such as asthma or emphysema. 
Seizures (may occur with severe hypoxemia).

**Immediate Interventions**
- **STAT** notify physician, PA, or NP and RT of decline in respiratory function. 
- Elevate HOB; position patient to facilitate breathing. 
- Assess whether the airway is patent and if patient is alert enough to manage secretions and to protect airway. 
- **SI** Insert nasal or oral airway, and suction if patient cannot clear secretions. 
- Apply supplemental oxygen via nasal prongs or face mask to correct hypoxemia and keep oxygen saturation >90%. **SI** Use O₂ cautiously in patients with severe COPD and chronic CO₂ retention. 
- Document patient’s status, phone call to provider, and provider’s response. 

**Focused Assessment**
- Assess oxygenation, lung sounds, respiratory rate, and work of breathing; assess for circumoral or nail bed cyanosis. 
- Assess VS, LOC, and orientation. 
- Assess for underlying cause of respiratory distress. 

**Stabilizing and Monitoring**
- **QI** Life support initiated; patient transferred to ICU. 
- Assess cardiac monitor, BP, pulse oximetry, and ABG results. 
- Insert IV access. 
- Continue to assess LOC, orientation. 
- Administer medications to treat underlying cause. 
- **RI** If hypoxemia is severe, intubation and mechanical ventilation to increase PaO₂, lower PaCO₂, and rest respiratory muscles will be required.
Assist with diagnostic and laboratory studies (portable CXR, ABGs, ECG, other diagnostic tests, sputum culture, and bronchoscopy).

**Be Prepared To**
- Call a code.
- Assist with intubation.
- Transfer to ICU.

**Possible Causes**
- *Hypoxemic respiratory failure*: COPD, pneumonia, pulmonary edema, pulmonary fibrosis, asthma, pneumothorax, pulmonary embolism, pulmonary arterial hypertension, pneumoconiosis, granulomatous lung diseases, bronchiectasis, adult respiratory distress syndrome, fat embolism syndrome.
- *Hypercapnic respiratory failure*: COPD, severe asthma, drug overdose, poisonings, myasthenia gravis, polyneuropathy, poliomyelitis, primary muscle disorders, head and cervical cord injury, primary alveolar hypoventilation, obesity hypoventilation syndrome, pulmonary edema, adult respiratory distress syndrome, myxedema.

### Ventilators/Mechanical Ventilation

**Indications**
- Airway obstruction.
- Inadequate oxygenation: \( O_2 \) saturation <90% on high-flow oxygen via nonrebreather mask.
- Inadequate ventilation: hypoventilation (ineffective breathing pattern).
- Airway protection.

**Common Settings**
- **AC** (assist control): patient triggers ventilator to deliver a breath. If apnea occurs, a minimum rate and volume is delivered to the patient.
- **CPAP**: continuous, nonstop positive pressure is applied throughout entire respiratory cycle.
- **BiPAP**: same as CPAP but with two preset pressure settings: one for inspiration and one for expiration.
- **CMV** (continuous mandatory ventilation): ventilator delivers a set tidal volume at a set rate regardless of patient’s own attempts to breathe. Expect patient to require sedation.
- **IMV** (intermittent mandatory ventilation): ventilator delivers a set tidal volume at a set rate, yet also allows the patient to initiate breaths.
- **PSV** (pressure support ventilation): for patients with spontaneous breathing. Ventilator delivers a preset positive pressure for the duration of inspiration when the patient initiates a breath.
SIMV (synchronized intermittent mandatory ventilation): ventilator is triggered only by a patient-activated demand valve and therefore synchronizes with the patient’s own respiratory efforts.

PEEP (positive end-expiratory pressure): maintains a preset positive airway pressure at the end of each expiration. PEEP is used if a $\text{PaO}_2$ of 60 mm Hg cannot be achieved with an $\text{FiO}_2$ of 60%.

### Troubleshooting Ventilator Problems

**Patient in sudden, severe respiratory distress:**

- Call for help. Unhook the ventilator from the endotracheal (ET) tube, and manually ventilate patient with 100% oxygen using an Ambu bag.

- **If patient is easy to ventilate manually** and is no longer in distress, the ventilator is the probable source of the problem. Notify RT. While you manually ventilate the patient, RT should assess the ventilator per manufacturer’s guidelines. The ventilator may need to be changed if the problem cannot be found.

- **If patient is difficult to ventilate manually**, suction the ET tube to clear secretions. Notify RT. If unable to clear obstruction or pass suction catheter, you may have to extubate and manually ventilate the patient with 100% oxygen using an Ambu bag and face mask. This can be done only by a very experienced nurse in an ICU in an emergency. Suction the oropharynx to clear secretions. Notify RT/physician, and assist with reintubation.

- Assess for air leak. Listen for air around the cuff, and check cuff pressure with a manometer if available. Notify RT for possible reintubation if air leak cannot be fixed.

- Assess for dislodgement. If tube is dislodged, remove and manually ventilate patient with 100% oxygen using Ambu bag and face mask. Suction oropharynx to clear secretions. Notify RT/physician and assist with reintubation.

- Assist with reintubation if needed or replacement of ventilator or ventilator components.

- If ineffective ventilation continues, inspect and auscultate the patient’s chest for equal and adequate air entry. If there is unequal chest wall movement and/or decreased air entry on one side, it may be related to a malpositioned tube, atelectasis, or a tension pneumothorax. Notify physician and RT.

- If ineffective ventilation continues and no physical or mechanical cause can be found, consider sedating the patient.
Ventilator Alarms: Implications and Interventions

When the ventilator alarms, check the patient first. If patient is in no apparent distress, check ventilator to determine source of problem. If patient is showing signs of distress (“fighting the vent”), try to calm the patient. If unsuccessful, immediately disconnect patient from ventilator, manually ventilate with 100% oxygen using an Ambu bag, and call for help.

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-Pressure Alarm</strong></td>
<td>Reconnect patient to ventilator. Evaluate cuff, and reinflate if needed (if ruptured, ET tube must be replaced). Evaluate connections; tighten or replace as needed. Check ET tube placement (auscultate lung fields, and assess for equal, bilateral breath sounds).</td>
</tr>
<tr>
<td>Usually caused by system disconnections or leaks.</td>
<td></td>
</tr>
<tr>
<td><strong>High-Pressure Alarm</strong></td>
<td>Suction patient if secretions are suspected. Insert bite block to prevent biting ET tube. Reposition head and neck or reposition tube. Sedation may be required to prevent a patient from fighting the vent, but only after careful assessment excludes a physical or mechanical cause.</td>
</tr>
<tr>
<td>Usually caused by resistance within the system. Can be kink or water in ET tubing, patient biting the tube, copious secretions, or plugged tube.</td>
<td></td>
</tr>
<tr>
<td><strong>High RR</strong></td>
<td>Suction patient. Look for source of anxiety (e.g., pain). Evaluate oxygenation. Evaluate/reinflate cuff; if ruptured, ET tube must be replaced.</td>
</tr>
<tr>
<td>Can be caused by anxiety or pain, secretions in ET tube/airway, hypoxia.</td>
<td></td>
</tr>
<tr>
<td><strong>Low Exhaled Volume</strong></td>
<td>Evaluate connections; tighten or replace as needed. Check ET tube placement; reconnect to ventilator.</td>
</tr>
<tr>
<td>Usually caused by ET tubing disconnection, inadequate seal.</td>
<td></td>
</tr>
</tbody>
</table>
Tracheostomy Tube Dislodgement

The Patient May Have . . .

- Noisy breathing, increased work of breathing, subcutaneous emphysema around site, obviously mispositioned trach tube or flange, clearly visible cuff in the stoma, absent breath sounds on auscultation.
- **Note:** If patient is on a ventilator, the first indication may be a low-pressure alarm. Also suspect dislodgement when a new tracheostomy patient can speak. Speaking is not possible unless the opening is occluded.

**Immediate Interventions**

**RI** If the tracheostomy is less than 1 week old, immediate intervention is required because the tract can collapse suddenly closing the airway. Page RT and physician, PA, or NP. Only trained personnel should replace a new tracheostomy tube.

**RI** Open the tracheostomy with a sterile hemostat, suction catheter, or sterile gloved finger to maintain airway patency and prevent the edges of the tracheostomy from collapsing.

**RI** If patient cannot breathe, ventilate with an Ambu bag.

**RI** If you cannot be sure that someone clinically prepared to reinsert the tracheostomy tube will arrive within 1 min, call a code.

- **If the tracheostomy is older than 1 week,** the tract will be well formed and will not close quickly.
- Notify physician, PA, or NP and respiratory therapist that tube needs to be replaced.

**SI** Stay with patient, and prepare for insertion of new tube.

- Document patient’s status, phone call to provider and provider’s response.

**Focused Assessment**

- Assess patient’s ability to breathe through stoma.
- Assess \( \text{SaO}_2 \).
- Assess tracheostomy site for secretions (blood, mucus, etc.), swelling, or subcutaneous emphysema.
- Auscultate lungs, and assess patient’s ability to cough effectively and clear airway.

**Stabilizing and Monitoring**

**OI** Safe, prompt replacement of tracheostomy tube; optimal oxygenation throughout.
After tube is reinserted and tracheostomy dressing is in place, check that ties are secure but not excessively tight. You should be able to easily insert one finger under the ties.

- Administer humidified supplemental O₂.
- Assess oxygenation status by monitoring LOC and SaO₂.

For future tracheostomy care, have another nurse hold tube in place while ties are changed.

- Obtain new sterile hemostat, sterile obturator, and replacement tracheostomy tube to be kept at bedside.
- Chart patient status, and report to physician, PA, or NP.

**Be Prepared To**

- Call a code.
- Assist with the insertion of a new tracheostomy tube.
- Perform tracheostomy care.

**Possible Causes**

- Coughing, patient movement, poorly secured tracheostomy tube, accidental self-extubation, excessive torque or tension on a tracheostomy tube attached to a ventilator or other O₂ administration device, deflated tracheostomy cuff.

**Basic ABG Interpretation**

**Values Measured**

- ABGs provide a lot of information but the primary purpose is to determine acid-base balance and oxygenation status.
- SaO₂ is the oxygen saturation, frequently called O₂-sats. Normal is 95% to 100%.
- PacO₂ is the partial pressure of oxygen in arterial blood and is referred to as p-O₂. Normal is 80-100 mmHg. PAO₂—with a capital A—is the partial pressure of oxygen in the alveoli.
- PacO₂ is the partial pressure of carbon dioxide in the arterial blood. People generally call it C-O₂. Think of this as an acid, which it is, even though it is a gas. If you’re having trouble understanding a blood gas, substitute the word “acid” for CO₂. Normal is 35-45 mmHg. PACO₂—with a capital A—refers to alveolar CO₂.
- HCO₃ is bicarbonate, usually called bicarb. It is alkaline, which means the same as base or buffer. You can think of it as an antacid to help you understand the body’s acid-base balancing system. Normal is 22-26 mEq/L.
pH is a numerical scale that measures the acidity or alkalinity of a solution. pH ranges from 0, the most acidic, to 14, the most alkaline. A pH of 7 is neutral. Blood pH must fall between 7.35 and 7.45 to maintain homeostasis.

**Acid-Base Problems**

- Assessing acid-base problems means determining whether the blood is acidic or alkaline and whether the problem is metabolic or respiratory.
- You need three results to determine this: pH, CO₂, and HCO₃.
- Start by drawing the following grid and labeling the CO₂ row for respiratory and the HCO₃ row for metabolic. The right column is for recording if the results indicate acid or base, or if the results are normal.

<table>
<thead>
<tr>
<th>Patient Results</th>
<th>A, B, N*</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td></td>
</tr>
<tr>
<td>CO₂ (respiratory)</td>
<td></td>
</tr>
<tr>
<td>HCO₃ (metabolic)</td>
<td></td>
</tr>
</tbody>
</table>

*A = acid; B = base; N = normal.

**Sample ABG and Interpretation**

- ABG results are pH = 7.32; CO₂ = 50 mm Hg; HCO₃ = 27 mEq/L.
- Enter the pH value.
  - pH <7.35 is acidic; pH >7.45 is alkaline.
  - If the pH is normal, put an N in the third column; if it is acidic, put an A; if it is alkaline, put a B.
- Look at the CO₂.
  - CO₂ >45 is acidic; CO₂ <35 is alkaline.
  - If the CO₂ is normal, put an N in the third column; if it is high, put an A; if it is low, put a B.
- Evaluate HCO₃.
  - HCO₃ <21 is acidic; HCO₃ >28 is alkaline.
  - If the HCO₃ is normal, put an N in the third column; if it is low, put an A; if it is high, put a B.
- Compare the pH letters (A, B, or N) to the CO₂ and the bicarb letters.
  - Whichever matches the pH letter is the source of the problem.
  - Identify the source and write metabolic or respiratory under the grid.
If the pH is below normal, write acidosis under the grid; if it is above normal, write alkalosis. Your grid should look like this:

<table>
<thead>
<tr>
<th>Patient Results</th>
<th>A, B, N</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH 7.32</td>
<td>A</td>
</tr>
<tr>
<td>CO₂ (respiratory) 50 mm Hg</td>
<td>A</td>
</tr>
<tr>
<td>HCO₃ (metabolic) 26 mEq/L</td>
<td>N</td>
</tr>
</tbody>
</table>

Compensation

- When the pH is falling or rising, the body tries to compensate to return the pH to normal or closer to normal.
- Depending on what is needed, the body changes CO₂ levels by increasing or decreasing respiratory rate or changes HCO₃ levels by signaling the kidneys to increase or decrease bicarb excretion.
- The result is two abnormal factors (CO₂ and bicarb) with a normal pH (compensated) or a near normal pH (partially compensated).
- Even with a normal pH, you can tell whether the problem is respiratory or metabolic because the body will not overcompensate. This means compensatory mechanisms will not put the pH past 7.4 in either direction; it will be either trending acidic (pH 7.35–7.39) or trending alkalotic (pH 7.41–7.45). Whichever factor matches the trend of the pH is the source of the problem.
- In that situation, enter the pH as N on the grid, but with an A or B in parentheses depending on whether the pH is above or below 7.4. This will let you know the original imbalance.
- Example for results of pH 7.37, CO₂ 50 mm Hg, and HCO₃ 31 mEq/L:

<table>
<thead>
<tr>
<th>Patient Results</th>
<th>A, B, N</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH 7.37</td>
<td>N (A)</td>
</tr>
<tr>
<td>CO₂ (Resp) 50 mm HG</td>
<td>A</td>
</tr>
<tr>
<td>HCO₃ (Metabolic) 31 mEq/L</td>
<td>B</td>
</tr>
</tbody>
</table>
Summary of compensation:
- When pH is abnormal and only one factor is abnormal, it means there has been no compensation.
- Normal pH with abnormal CO₂ and abnormal HCO₃ means the body has compensated for the abnormality.
- Abnormal pH with abnormal CO₂ and abnormal HCO₃ means the body has partially compensated.
- Abnormal pH and abnormal CO₂ or abnormal HCO₃ indicates no compensation.

Mixed Metabolic and Respiratory Acid-Base Problems
- You can deduce that to correct a pH, the factor used to compensate for the abnormal factor will move in the opposite direction of the pH.
- Therefore, if the problem is too much CO₂ and the pH is acidic, the body will increase the buffer to add alkalinity, and vice versa. The grid will look like the previous example, with an A, a B, and an N with an A or B in parentheses next to the N.
- However, when both CO₂ and HCO₃ are going in the same direction toward acidity or alkalinity, compensation cannot occur, and the problem is called mixed acidosis or mixed alkalosis. The grid will have all As (mixed acidosis) or all Bs (mixed alkalosis).
- One mechanism may dominate, which is suggested by whichever factor (CO₂ or bicarb) is most abnormal.

Steps in Review
- Is the pH acidic or alkalotic or normal?
- Is the pH caused by a metabolic or respiratory problem?
- Is it a mixed metabolic and respiratory problem?
- Is it compensated, and if so, is it fully compensated or partially?
- Note: Use the blank grid in the Tools section for interpreting the ABG results of your patients.

Oxygenation
- The other purpose of an ABG is to assess oxygenation status.
- The two most frequently used measures of oxygen in the blood are SaO₂ and PaO₂. PaO₂ is a measure of the amount of oxygen dissolved in the blood. It reflects how well the lungs are getting oxygen into the bloodstream from the atmosphere. Normal PaO₂ = >80 mm Hg.
- PaO₂ 60–79 mm Hg = mild hypoxemia.
Pao\textsubscript{2} 40–59 mm Hg = moderate hypoxemia.
Pao\textsubscript{2} <40 mm Hg = severe hypoxemia.

Decreased Pao\textsubscript{2} levels are associated with:
- Anemia.
- Hypoventilation.
- Heart failure.
- COPD and other restrictive pulmonary diseases.

SaO\textsubscript{2} reflects to what degree oxygen is carried by hemoglobin. Hemoglobin has four oxygen-carrying sites. When all four sites have a molecule of oxygen attached, the hemoglobin is “saturated.”

**Normal SaO\textsubscript{2} is 95% to 100%**. Some patients may have lower levels and not be in distress; you must look at the whole picture and not just an isolated number.

An SaO\textsubscript{2} <90% requires rapid intervention unless it is within the patient’s baseline range.

**Note**: You will sometimes see Pao\textsubscript{2} (lowercase \(a\)) and PAO\textsubscript{2} (uppercase \(A\)). Pao\textsubscript{2} with the lowercase \(a\) is the partial pressure of oxygen in the arteries. PAO\textsubscript{2} with the uppercase \(A\) is the partial pressure of oxygen in the alveoli. Both are used to calculate the A–a gradient, which indicates how well the lungs are getting oxygen from the air into the pulmonary circulation. An elevated A–a gradient means the lungs are not performing well.

### Chest Tubes

- Chest tubes are used to reestablish normal intrathoracic pressures and remove air, blood, pus, or serous or lymphatic fluid from the pleural space.
- They may be placed at the bedside, in the emergency department, or in the operating room in conjunction with thoracic surgery.

### Indications

**Pneumothorax** (PTX): a collection of air in the pleural space resulting from a traumatic chest wall injury such as a puncture wound (an open pneumothorax) or from an internal perforation of the lung (a closed pneumothorax). Internal perforation can occur from a ruptured bleb, or blister, on the lung surface or from a broken rib. PTX is also a potential complication from placing a central line.
Tension PTX: a rapid accumulation of air in the pleural space, causing increased intrathoracic pressure, lung collapse, and displacement of thoracic contents (trachea, heart, and lungs) to the opposite side of the chest (mediastinal shift). The pressure and shifting markedly impair venous return and cardiac output. This is life threatening and must be addressed.

Signs and symptoms of tension PTX or PTX include:
- Rapid, labored respirations; hypoxemia; cyanosis.
- Tachycardia, sudden chest pain radiating to the shoulders.
- Hypotension, decreased cardiac output.
- Tracheal deviation, where the trachea is forced away from the side of the tension pneumothorax, is an ominous sign.

Hemothorax: a collection of blood in the pleural space resulting from trauma, blood clotting disorder, pulmonary infarct, cancer of the lung or pleura, placement of a central line, or thoracic surgery.

Empyema: a collection of pus in the pleural space.

Pleural effusion: a collection of lymphatic or serous fluid.

Drainage after thoracic surgery: serous-sanguineous fluids can collect in the mediastinum and pericardial space following thoracic surgery, potentially causing cardiac tamponade.

### Chest Tube Placement Sites

- A chest tube to treat an apical pneumothorax is placed between the second and third intercostal space at the midclavicular line. The placement is high because the free air in the chest will rise.
- A chest tube to evacuate air, blood, and fluid (mixed pneumothorax) is placed in the fourth or fifth intercostal space (about nipple level) at the mid to anterior axillary line. Most chest tubes are in this position.
- Chest tubes to drain blood and fluid that can collect in the mediastinum after thoracic or cardiac surgery are placed on either side and slightly below the xiphoid process.

### Types of Drainage Systems

- Drainage systems work either by gravity or suction; most setups allow for both. Often, the drainage system is set to suction but is then converted to gravity drainage (also called water seal drainage) as the patient's condition improves.
The degree of suction is controlled by water levels in the suction chamber, called wet suction, or by a dial control in the suction chamber, called dry suction.

**Water Seal and/or Wet Suction Systems**

- Usually, the container is a portable unit with three chambers:
  - **Collection chamber**: compartment on the right (when facing the front of the system) marked off in mL and holds 2,100–2,500 mL. Blood and serous fluid collect in this chamber. The unit must be kept below chest level to prevent reflux of drainage into the chest cavity.
  - **Water seal chamber**: center compartment. Water is added to this chamber to the 2-cm mark. This makes a seal that prevents air from being drawn into the pleural space when the patient inhales.
  - **Suction control chamber**: compartment on the left. Sterile water or saline is added to this compartment usually up to the 20-cm mark. The water level, *not the wall suction regulator*, regulates the amount of suction: less water, less suction; more water, more suction. Excessive suction can damage tissue; insufficient suction may delay recovery.

**Dry Suction Systems**

- Some newer systems do not require water to control the suction but still have a water seal chamber; others do not even have a water seal chamber but use a simple one-way valve instead.
  - **Dry suction water seal**: a three-compartment system like the traditional wet suction system except that the suction control chamber is regulated by a dial, not water depth. The middle chamber still has water to the 2-cm mark.
  - **Dry suction one-way valve systems**: One type has a collection unit, although it is much smaller than the unit on a wet suction system. This type is used when minimal drainage is expected. It consists of a one-way flutter valve (may be called a Heimlich valve) encased in a rigid, plastic small-volume (30-cc) collection chamber. It has no water seal but does have an air leak indicator. The second type is even simpler: a one-way valve inserted into the end of the chest tube. It then can be placed into a drainage bag like an ostomy bag or simply wrapped with dry dressings.
Managing the Drainage System

It is your job to keep the system functioning optimally and to intervene if a problem occurs. The following topics cover the most common or urgent problems.

**Proper Suction Control**
- Prescribed amount of suction is maintained either by the correct amount of water in the suction control chamber or by visualizing the popped bellows or float devices in dry suction setups.
- In wet suction units, apply enough wall suction so that the water bubbles continuously but gently. There is no need for vigorous bubbling.

**Understanding the Water Seal Column**
- The water seal column should fluctuate (move, not bubble) gently with respirations. If it does not, either the chest tube is obstructed or the lung has reexpanded.
- With mediastinal tubes, there is no fluctuation because the tubes are not in the pleural space.
- Occasional bubbles in the water seal are normal. It means that air is escaping the pleural space or air in the collection chamber is displaced by drainage accumulation.
- Continuous bubbling is not normal and means there is an air leak into the pleural space from the lung or bronchus or a leak somewhere in the system, such as a loose connector, cracked drainage unit, or tear in the tubing.
- Vigorous bubbling may mean the chest tube has slipped out completely or partially.

**Finding an Air Leak**
- You can try to locate cracks or leaks in the system by clamping the chest tube every few inches until the bubbling stops. If the bubbling stops, you can deduce that the leak is between where the tube was clamped last and where the tube is currently clamped.
- If you clamp the tube close to the patient and the bubbling stops, it suggests that the tube has come out or that there is a leak from the lung or bronchus.
- Clamping can be done only with a physician’s order because it can cause a tension pneumothorax.
- Assess each connection and the drainage unit for cracks or looseness.

Notify physician or nurse practitioner that there is an air leak.
Assess the dressing to determine whether there is evidence that the chest tube has become dislodged. If you think it has and the dressing is intact, leave the dressing on and notify the physician.

**RI** If the dressing is disrupted, quickly tape it securely and then notify the physician.

**RI** If the dressing is off and the tube is completely out or partially out, replace the Vaseline gauze and $4 \times 4s$, tape it, and notify the physician.

Call for another chest tube of the same size and a thoracostomy tray if the tube is partially or completely out.

**SI** A partially out chest tube is contaminated and should not be pushed back into the pleural space.

**Proper Care of the Drainage Unit**

- Maintain drainage system and tubing below the level of insertion.
- Tape the unit to the floor or hang it from the bed so that it does not get knocked over.
- Check that all connections are taped securely.
- Do not allow excess tubing to extend over the side of the bed and loop beneath the top of the drainage unit. The tubing should lay flat on the bed and then travel in a straight line to the unit to maintain proper drainage.
- Maintain correct levels of sterile water or saline in wet suction units.

**Milking or Stripping the Chest Tube**

- Milking chest tubes means alternately compressing and releasing short sections of the entire length of the tube, starting at the patient’s chest.
- Should be performed only with an order.
- May be indicated if drainage is bloody to prevent clots from obstructing the tube.

**Caring for the Patient**

- Have the patient exhale forcefully and cough periodically to help promote drainage.
- Having the patient sit up in bed or turn toward the chest tube also helps promote drainage.
- Assess VS every 4 hours.
Auscultate chest to assess for changes in condition. You may hear distant breath sounds or no breath sounds in various areas of the affected side. Document what you hear and the location. For example, “normal breath sound in right upper lung field with absent breath sounds at the right base. Left lung sounds normal throughout.”

- Assess drainage amount. Report amounts >70 mL/hr or if quality of drainage changes.
- If your patient has mediastinal chest tubes, listen to heart sounds and assess for cardiac tamponade. Signs and symptoms of tamponade include hypotension, narrowing pulse pressure, muffled or distant heart sounds, and distended neck veins.
- Assess area around chest tube dressings for crepitus, which indicates air in subcutaneous tissues. Palpation of crepitance sounds like popping and crackling.
- Assess patient’s level of comfort and tolerance of the chest tube.
- Assess for complications including respiratory distress, rapid or shallow breathing, tracheal deviation, chest pain, or excessive bleeding. Notify the physician immediately.

**RI** If the chest tube becomes dislodged or pulls out completely, apply Vaseline gauze immediately to the open wound, cover it with 4 × 4s, and tape it occlusively. Call the physician, PA, or NP and assess the patient for respiratory distress.

**SI QI RI** If the chest tube becomes disconnected from the drainage system, place the end of the chest tube in a container of sterile water. This forms a water seal and protects the patient from tension pneumothorax until a new drainage system can be set up. Then assess the patient for signs of increased respiratory difficulty and notify the physician immediately. Set up a new drainage unit, and reconnect the chest tube. Tape the new connection securely.
Cannula (Nasal Prongs)
- Indicated when low-flow, small-percentage oxygen therapy is desired.
- Flow rate of 1–6 L/min delivers 24%–44% oxygen.
- Allows patient to eat, drink, and talk.
- Extended use can dry the nose and nasopharynx; use with humidifier.

Simple Mask
- Indicated when desired Fio₂ to be delivered is 40%–60%.
- Flow rate of 6–10 L/min delivers 35%–60% oxygen.
- Lateral perforations permit exhalation of CO₂.
- Permits humidification.
**Bag-Mask (Nonrebreather)**

- Indicated when high concentrations of O₂ are desired.
- Flow rate of up to 15 L/min delivers up to 100% oxygen.
- One-way flaps open and close with respiration, resulting in a high concentration of delivered oxygen and minimal to no CO₂ rebreathed by the patient.

**Venturi Mask (Ventimask)**

- Indicated for precision titration of oxygen.
- Accurate delivery of O₂ is accomplished with a graduated dial that is set to the desired percentage of oxygen to be delivered.
- Flow rate of 4–8 L/min delivers 24%–40% oxygen.
Ambubag, Bag-Valve-Mask
- Indicated for resuscitation or to manually ventilate a patient.
- Can deliver up to 100% oxygen.
- Appropriate size and fit are essential both to create a good seal and to prevent injury.
- To create seal, hold mask with thumb and pointer finger (thumb toward nose), and grasp underneath the ridge of the jaw with remaining three fingers (see picture).

Humidified Systems
- Indicated for patients requiring long-term O2 therapy to prevent drying of mucous membranes.
- Setup may vary among brands. Fill canister with sterile water to recommended level, attach to oxygen source, and attach mask or cannula to humidifier.
- Adjust flow rate.

Transtracheal Oxygenation
- Indicated for patients with a tracheostomy who require long-term oxygen therapy and/or intermittent, transtracheal aerosol treatment.
- Ensure proper placement (over stoma, tracheal tube).
- Assess for and clear secretions as needed.
- Assess skin for signs of irritation.
Artificial Airways

Oropharyngeal Airway
- Indicated for unconscious patients who do not have a gag reflex.
- Measure either from the corner of the mouth to the earlobe or from the center of the mouth to the angle of the jaw.
- Rotate airway 180° while inserting into oropharynx.

Nasopharyngeal Airway
- Indicated for patients with a gag reflex, comatose with spontaneous respirations, lockjaw.
- Measure from the tip of the patient’s nose to the earlobe.
- The diameter should match that of the patient’s pinkie.
- NEVER insert in the presence of facial trauma.
Endotracheal Tube

- Indicated for apnea, airway obstruction, respiratory failure, risk of aspiration, combative patient (protect from further injury), or when goal of therapy is hyperventilation.
- Can be inserted through the mouth or nose.
- Inflated cuff protects patient from aspiration.
Rapid Neurological Assessment

A rapid neurological assessment includes assessing level of consciousness/mental status, cranial nerves, sensory and motor function, reflexes, coordination, and balance. A basic assessment can be done just by watching the patient walk, listening to him talk, and looking at his eyes. This tests motor strength, balance, coordination, vision, speech, cognitive ability, level of consciousness, and orientation, among other functions.

- **Assess level of consciousness/responsiveness.**
  - Level of consciousness (LOC) refers to how awake and alert a person is. It begins with full consciousness (awake and alert) and declines to comatose with no response to any stimuli.
  - If the patient is not fully awake and alert, test what actions are necessary to awaken the patient or to get any response whatsoever.
  - For people who can be awakened, no matter how briefly, test by calling the patient’s name, lightly touching her to awaken, or shaking the patient’s shoulder while calling her name loudly. The following table explains how to describe the patient’s level of consciousness correctly.
  - For the patient in a coma, assess whether the patient responds to a painful stimulus and what the response is. (See Glasgow Coma Scale, pp 71–72.)

<table>
<thead>
<tr>
<th>Levels of Consciousness</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full consciousness</td>
<td>Awake and alert.</td>
</tr>
<tr>
<td>Lethargic</td>
<td>Sleeps frequently but wakens to spoken word or gentle shake. Maintains wakefulness with sufficient stimulation.</td>
</tr>
<tr>
<td>Obtunded</td>
<td>Extreme drowsiness, requires more vigorous stimulation to waken, and stays awake for only a few minutes at a time.</td>
</tr>
<tr>
<td>Stuporous</td>
<td>Minimal movement, responds unintelligibly, and wakens briefly only to repeated vigorous stimulation.</td>
</tr>
<tr>
<td>Comatose</td>
<td>Does not respond to verbal or tactile stimuli. May have appropriate motor response to painful stimuli (i.e., withdraws), nonpurposeful response, or no response.</td>
</tr>
</tbody>
</table>
Assess level of orientation.

- Orientation level indicates the ability of the cerebral cortex to receive and interpret sensory information appropriately.
- Orientation level is described as being “times” 1, 2, or 3 with times, with 1 meaning oriented to person only, times 2 meaning oriented to person and place, and times 3 meaning oriented to person, place, and time (i.e., fully oriented).
- When orientation begins to decline, the first factor to go is time, followed by place, then person. Other cognitive skills, such as reasoning ability, also decline.
- To assess orientation, ask the patient her name (person), where she is (place), and the date (time). If the patient cannot answer accurately, ask a less specific question, such as what kind of place she thinks she is in or what month it is.

### Orientation Descriptors

<table>
<thead>
<tr>
<th>Description</th>
<th>Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriented × 3</td>
<td>Understands spoken and written language (assuming literacy) and responds reliably.</td>
</tr>
<tr>
<td>Oriented × 2</td>
<td>Guesses at the date; may be able to provide general time of year. May have some difficulty following complicated instructions and have memory deficits.</td>
</tr>
<tr>
<td>Mildly confused</td>
<td></td>
</tr>
<tr>
<td>Oriented × 1</td>
<td>Unable to give even approximate date or relate where he or she is. Has memory deficits and difficulty following commands. Can be restless or agitated.</td>
</tr>
<tr>
<td>Confused</td>
<td></td>
</tr>
<tr>
<td>Disoriented</td>
<td>Patient does not answer appropriately or at all when asked his or her name. Unable to follow directions. May be agitated or hallucinating.</td>
</tr>
</tbody>
</table>
Assess motor strength and function.
- Ask the patient to move all four extremities. See the following Muscle Strength Scale to describe muscle strength.
- Have the patient squeeze the fingers of each of your hands with each of her hands. Describe strength and whether both hands are equal in strength.
- Hold your hand up and have the patient push your hand while you provide resistance. Also have her grasp your hand and pull while you resist. Test both arms. Describe strength and whether both arms are equal in strength.
- Have the patient hold both arms and close her eyes. Note whether either arm drifts.
- Have the patient dorsiflex (push heel away from the body and point toes toward head) and plantarflex (point toes out straight and down) her feet. Provide resistance.
- Have the patient do straight leg raises with and without resistance.

<table>
<thead>
<tr>
<th>Muscle Strength Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 No muscle movement.</td>
</tr>
<tr>
<td>1 Visible muscle movement but no movement at the joint.</td>
</tr>
<tr>
<td>2 Movement at the joint but not against gravity.</td>
</tr>
<tr>
<td>3 Movement against gravity but not against added resistance.</td>
</tr>
<tr>
<td>4 Movement against resistance but less than normal. This can be subdivided into 4– and 4+.</td>
</tr>
<tr>
<td>5 Normal strength.</td>
</tr>
</tbody>
</table>

Test pupil response.
- Assess the size, shape, and symmetry of each pupil. They should be equal but a variation of <1 mm is not significant. Unequal pupil size >1 mm requires immediate notification of the physician, physician’s assistant (PA), or nurse practitioner (NP).
- Using a penlight, quickly shine the light into each pupil. The pupils should constrict briskly and equally.
Bilateral dilation can be caused by medications such as anticholinergic drugs or by prolonged cerebral anoxia.

Bilateral constriction can be caused by an intracranial hemorrhage or medications such as opiates and organophosphates.

Glasgow Coma Scale (GCS)

The GCS is a tool for assessing level of consciousness (LOC).

**Best Eye Response (E)**
- Spontaneously 4
- On command 3
- To pain 2
- No response 1
Score: _______

**Best Verbal Response (V)**
- Alert and oriented 5
- Confused 4
- Inappropriate 3
- Incomprehensible 2
- No response 1
Score: _______

**Best Motor Response (M)**
- Follows direction 6
- Localizes pain 5
- Withdraws from pain 4
- Abnormal flexion 3
- Abnormal extension 2
- No response 1
Score: _______

Continued
Score may range from 3 (lowest neurological function) to 15 (highest function). However, a number of combinations of eye opening, verbal response, and motor response will give the same score. To provide a clearer picture of the patient’s neurological functioning, record the score in the following manner:

\[ \text{GCS} = 9/15 \ (E = 2, \ V = 3, \ M = 4) \]

This is read as “Glasgow Coma Score = 9 out of a possible 15, eye opening score 2, verbal response score 3, motor response score 4.”

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Function</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Olfactory</td>
<td>Smell</td>
<td>Identify familiar odors (e.g., coffee, peppermint).</td>
</tr>
<tr>
<td>II Optic</td>
<td>Visual acuity</td>
<td>Assess visual acuity using eye chart.</td>
</tr>
<tr>
<td></td>
<td>Visual field</td>
<td>Assess peripheral vision.</td>
</tr>
<tr>
<td>III Oculomotor</td>
<td>Pupillary reaction</td>
<td>Assess pupils for equality and reactivity to light.</td>
</tr>
<tr>
<td>IV Trochlear</td>
<td>Eye movement</td>
<td>Patient follows finger without moving head.</td>
</tr>
<tr>
<td>V Trigeminal</td>
<td>Facial sensation and movement</td>
<td>Touch face to assess for sharp and dull sensation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Have patient hold mouth open.</td>
</tr>
<tr>
<td>VI Abducens</td>
<td>Motor function</td>
<td>Patient follows finger without moving head.</td>
</tr>
<tr>
<td>VII Facial</td>
<td>Taste and facial movement</td>
<td>Have patient smile, wrinkle face, puff cheeks.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patient differentiates between sweet and salty taste.</td>
</tr>
</tbody>
</table>

Continued
## Cranial Nerve Assessment—cont’d

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Function</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIII Acoustic</td>
<td>Hearing and balance</td>
<td>Snap fingers close to patient’s ears. Have patient stand with feet together, arms at side, eyes closed for 5 sec.</td>
</tr>
<tr>
<td>IX Glossopharyngeal</td>
<td>Swallowing and voice</td>
<td>Have patient swallow and then say “Ah.”</td>
</tr>
<tr>
<td>X Vagus</td>
<td>Gag reflex</td>
<td>Use tongue depressor or swab to elicit gag reflex.</td>
</tr>
<tr>
<td>XI Spinal accessory</td>
<td>Neck motion</td>
<td>Patient shrugs or turns head against resistance.</td>
</tr>
<tr>
<td>XII Hypoglossal</td>
<td>Tongue movement</td>
<td>Patient sticks out tongue and moves it from side to side.</td>
</tr>
</tbody>
</table>

## Mini-Mental Status Examination

<table>
<thead>
<tr>
<th>Task</th>
<th>Instructions</th>
<th>Scoring</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date orientation</td>
<td>“Tell me the date.” Ask for omitted items.</td>
<td>1 point each for year, season, date, day of week, and month.</td>
<td></td>
</tr>
<tr>
<td>Place orientation</td>
<td>“Where are you?” Ask for omitted items.</td>
<td>1 point each for state, county, town, building, and floor or room.</td>
<td></td>
</tr>
<tr>
<td>Register three objects</td>
<td>Name three objects slowly and clearly. Ask patient to repeat them.</td>
<td>1 point for each item repeated correctly.</td>
<td></td>
</tr>
</tbody>
</table>

*Continued*
## Mini-Mental Status Examination—cont’d

<table>
<thead>
<tr>
<th>Task</th>
<th>Instructions</th>
<th>Scoring</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial 7s</td>
<td>Ask patient to count backward from 100 by 7. Stop after five answers (or ask patient to spell “world” backward).</td>
<td>1 point for each correct answer (or letter).</td>
<td></td>
</tr>
<tr>
<td>Recall three objects</td>
<td>Ask patient to recall the objects mentioned previously.</td>
<td>1 point for each item remembered correctly.</td>
<td></td>
</tr>
<tr>
<td>Naming</td>
<td>Point to your watch and ask, “What is this?” Repeat with a pencil.</td>
<td>1 point for each correct answer.</td>
<td></td>
</tr>
<tr>
<td>Repeating a phrase</td>
<td>Ask patient to say “No ifs, ands, or buts.”</td>
<td>1 point if successful on first try.</td>
<td></td>
</tr>
<tr>
<td>Verbal commands</td>
<td>Give patient a plain piece of paper and say, “Take this paper in your right hand, fold it in half, and put it on the floor.”</td>
<td>1 point for each correct action.</td>
<td></td>
</tr>
<tr>
<td>Written commands</td>
<td>Show patient a piece of paper with “Close your eyes” printed on it.</td>
<td>1 point if patient closes eyes.</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Ask patient to write a sentence.</td>
<td>1 point if sentence has a subject and a verb and makes sense.</td>
<td></td>
</tr>
</tbody>
</table>

Continued
Mini-Mental Status Examination—cont’d

<table>
<thead>
<tr>
<th>Task</th>
<th>Instructions</th>
<th>Scoring</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing</td>
<td>Ask patient to copy a pair of intersecting pentagons onto a piece of paper.</td>
<td>1 point if the figure has 10 corners and 2 intersecting lines.</td>
<td></td>
</tr>
</tbody>
</table>

Total possible score = 30. A score of 24 or above is considered normal.

The Agitated Patient

- Agitation is both a symptom of a serious underlying problem and a potential patient management crisis. Agitated patients are a danger to themselves and others. See tables on pp 76-77 for description of levels of agitation and sedation and de-escalation strategies.
- Agitated patients are difficult to examine making diagnosis and treatment challenging. The significance of this is multiplied by the fact that agitation is often a symptom of serious and life-threatening conditions.
- Patients can become agitated for a number of physiological reasons, including:
  - Decreased cardiac output and cerebral blood flow.
  - Hypoxemia or elevated CO₂.
  - Fluid and/or electrolyte imbalances.
  - Brain injury, stroke, tumor.
  - Adverse drug reaction.
  - Drug and/or alcohol intoxication or withdrawal.
- Agitated patients are often treated with sedatives, including:
  - Benzodiazepines such as lorazepam (Ativan) or diazepam (Valium).
  - Antipsychotics such as haloperidol (Haldol) or risperidone (Risperdal).
- Sedatives must be dosed carefully and can be overused or reach toxic levels from underlying liver or renal disease.
Patients on sedatives should be assessed frequently for the desired response (decreased agitation) and observed for signs of overdosage:
- Sleeping excessively and difficult to awaken.
- Respiratory depression or irregular breathing.
- Changes in heart rate (HR) or blood pressure (BP).

### Agitation-Sedation Descriptions

<table>
<thead>
<tr>
<th>Description</th>
<th>Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severely agitated</td>
<td>Overtly combative and potentially violent; threatens staff; pulls out catheters and intravenous (IV) lines; may thrash in bed if restrained or climb over bed rails and try to escape.</td>
</tr>
<tr>
<td>Very agitated</td>
<td>Confrontational and potentially combative; paces if ambulatory or moves restlessly in bed; may remove catheters and IV lines.</td>
</tr>
<tr>
<td>Agitated/restless</td>
<td>Appears distressed and anxious but does not threaten staff; moves purposelessly in bed; tries to calm down when asked.</td>
</tr>
<tr>
<td>Calm and cooperative</td>
<td>Awake and pleasant.</td>
</tr>
<tr>
<td>Drowsy/lightly sedated</td>
<td>Dozes off and on but awakens with verbal stimuli, to eat, or to use the bathroom. Falls back to light sleep easily.</td>
</tr>
<tr>
<td>Overly sedated</td>
<td>Difficult to wake and stays awake only for a few seconds.</td>
</tr>
<tr>
<td>Deeply sedated/ unarousable</td>
<td>Does not awaken to name-calling, vigorous shaking, or painful stimulus.</td>
</tr>
</tbody>
</table>
De-Escalation Strategies for Mild to Moderately Agitated Patients

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not add to the negative energy.</td>
<td>Project a calm attitude and open body language.</td>
</tr>
<tr>
<td>Allow the patient plenty of personal space and protect your own safety.</td>
<td>Stand at least 6 feet from the patient and avoid having too many people in the room. Keep your path to the door open.</td>
</tr>
<tr>
<td>Acknowledge the patient’s concerns and feelings.</td>
<td>Address what issues you can; express regret for events that may have offended the patient. For example, “I’m sorry that happened to you.”</td>
</tr>
<tr>
<td>Help the patient feel more in control.</td>
<td>Offer a simple choice such as, “Would you like something to drink... coffee or juice?”</td>
</tr>
<tr>
<td>Find ways to agree with the patient that are authentic but do not validate paranoid or delusional thinking.</td>
<td>“I agree that everyone should be treated with respect.” Or “I think I’d find that upsetting, too.”</td>
</tr>
<tr>
<td>Once the patient’s concerns have been acknowledged, politely redirect the conversation to the health examination.</td>
<td>“May I ask you what your health has been like recently?” Or “Please tell me about your health concerns.”</td>
</tr>
</tbody>
</table>

Change In LOC

The Patient May Have . . .

- Decline in usual state of consciousness.
- Confusion, lethargy, obtundation, stupor, or coma (see following table for definitions).
- Difficulty responding or inability to respond to verbal stimuli.
- No ability to speak, obey commands, or open eyes in response to verbal or painful stimuli.
Immediate Interventions

**QI** Assess and protect airway.  
- Administer supplemental \( O_2 \) if breathing pattern is adequate.

**RI** Venilate with an Ambu bag if patient is not breathing adequately (respiratory rate <8 and/or cyanosis).

- Suction the oropharynx, and clear secretions as needed; insert nasal airway if necessary.
- Assess VS, \( O_2 \) saturation, and pupillary reaction.
- Raise side rails and turn on bed alarm.
- Notify physician, PA, or NP.
- Document patient’s status, phone call to provider, and provider’s response.

Focused Assessment

- Reassess airway patency; check for secretions/obstructions.
- Assess breathing and oxygenation.
- Assess HR and cardiac rhythm.
- Assess LOC (see GCS in this tab), pupil reactivity and size, best motor response, and orientation.
- Assess responsiveness to verbal or painful stimuli. Note: Does patient respond to verbal stimuli? If not, does patient respond to gentle stimuli (shaking the arm) or only to painful stimuli (e.g., grasping the pectoralis muscle)? Is the motor response to stimuli purposeful (removing or withdrawing from the stimulus)?
- Assess for associated neurological deficits such as weakness or numbness on one side of the body.
- Assess medication administration record (MAR) for drugs capable of causing altered LOC.

Stabilizing and Monitoring

**QI** Summon appropriate team members; initiate work-up for change in LOC, transfer patient to appropriate level of care.

- Collaborate with health care team to identify and treat underlying causes (such as drug overdose).
- Continue to monitor vital signs (VS), breathing, and oxygenation closely.
- Continue to monitor neurological status.

Be Prepared To

- Assist with airway management or intubation if needed.
- Start an IV.
- Give medications.
- Order laboratory tests.
- Transfer patient to intensive care unit (ICU).
Possible Causes
■ Brain lesions/interruptions in blood flow, metabolic disorders (hypoglycemia, hypoxia), psychiatric disorder, toxic medication levels/drug overdose, increasing intracranial pressure (ICP), dysrhythmias.

Change in Mental Status/Delirium

The Patient May Have . . .
■ Confusion, restlessness, agitation, disorientation; develops over a short period of time and may wax and wane throughout the day.
■ Delusional thinking, hallucinations, reduced ability to focus, sustain or shift attention.
■ Disturbed general appearance, motor activity, dress, and facial expression.
■ Agitation or obtundation with fluctuating LOC.
■ Rambling, disorganized speech.
■ Impaired cognitive function.
■ Reversal of sleep–wake cycle.
■ Fever and tachycardia.

Immediate Interventions
SI Assist patient to safe area or back to bed.
QI Position to maintain patent airway.
■ Provide supplemental O₂ if saturation in room air is 93% or less (per optimal baseline).
■ Check MAR for recently given medications.
SI Stay with patient, and notify physician, PA, or NP.
RI If change in mental status is dramatic, STAT page physician to the room or call rapid response team.
■ Document patient status, phone call to provider, and provider’s response.

Focused Assessment
■ Assess breathing pattern.
■ Assess VS and indicators of hypoperfusion (capillary refill time, skin temperature). Note cardiac rate and rhythm. Note if patient is febrile or has a very low temperature.
■ Assess neurological/mental status with Mini-Mental Status Examination or GCS (see tables in this tab).
Assess for history of alcohol abuse, medication use, and psychiatric illness.
Assess for possible source of infection.
Check blood glucose by finger stick to rule out hypoglycemia.

**Stabilizing and Monitoring**

- **OI** Immediate investigation into cause of delirium; patient safety and treatment prioritized; patient transferred to appropriate level of care.
- Continue to assess neurological status, motor function, and respiratory function.
- Auscultate lungs for adventitious sounds.
- Enhance safety of environment.
- Avoid use of restraints.
- Assess nutritional status and ability to take foods and fluids.
- Monitor intake and output (I&O) and fluid status.
- Monitor laboratory results.
- Collaborate with health care team to treat identified cause(s).
- Document patient status and communicate to physician.

**Be Prepared To**

- Obtain blood, sputum, and urine cultures; occult infection is often the underlying cause of delirium.
- Start a peripheral IV.
- Obtain laboratory work; prepare patient for diagnostic studies.
- Administer appropriate medications as ordered.
- Arrange for one-on-one care.

**Possible Causes**

- Hypoglycemia, hypoxia, low BP, compromise of cerebral blood supply (stroke), elevated ammonia levels (end-stage liver failure), toxic medication levels, drug-induced psychosis, urosepsis (especially in the elderly), structural lesions, metabolic disorders, psychiatric disorders, renal disease, compromise of cerebral blood flow.

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**Dizziness**

**The Patient May Have . . .**

- Sensation of spinning (vertigo), disequilibrium, or faintness.
- Weakness, nausea.
- Chest pain, tightness, squeezing, or pressure.
Shortness of breath, palpitations.
Tingling, pins-and-needles, weakness of extremities.

Immediate Interventions
- Assist patient to safe place to sit or lie down.
- Administer supplemental O₂ if already ordered.
- Assess VS.
- Encourage slow, deep breaths.
- Stay with patient and provide reassurance.
- Notify physician, PA, or NP, document patient’s status, phone call to provider, and provider’s response.

Focused Assessment
- Assess VS and respiratory status.
- Assess cardiac rhythm and rate; assess for orthostasis (take BP supine, sitting, and standing; note changes in systolic BP and HR).
- Assess for circumoral cyanosis, skin temperature, and moistness.
- Assess MAR for recently taken medications that can cause dizziness.
- Assess history of similar episodes.
- Assess for history of inner ear disease or migraine.
- Assess recent laboratory values for electrolyte abnormality.
- If patient is diabetic, obtain blood glucose level by finger stick.

Stabilizing and Monitoring
- Support patient’s safety, identify cause of dizziness, and initiate appropriate treatment.
- Administer medications for dizziness as ordered.
- Assess VS and subjective feeling of dizziness.
- Help patient with ambulation and self-care until dizziness resolves.
- Monitor I&O.
- Monitor laboratory values.

Be Prepared To
- Start an IV.
- Assist with diagnostic testing.

Possible Causes
- Hypertension, hypotension, stroke, hypoglycemia, cardiac dysrhythmias, myocardial infarction, neuropathy, deconditioning, dehydration, arteriosclerosis, Ménière’s disease, medications, migraine, hyperventilation.
The Patient May Have . . .
- Scalp lacerations, hematoma, bilateral orbital ecchymosis, or Battle’s sign (bruising behind the ear at the mastoid process).
- Alteration in mental status or LOC; may be agitated, semiconscious, conscious, or unconscious; may have seizures.
- Cerebrospinal fluid (CSF) leakage from ear or nose.
- Signs of ICP:
  - Decreasing LOC, deterioration in GCS score.
  - Cushing’s response (bradycardia, hypertension, bradypnea).

Immediate Interventions
- Assess airway, breathing, circulation; assess VS.
  - QI Call for assistance, and notify physician, PA, or NP.
- RI Open airway and inspect. Clear blood, vomitus, or secretions.
- SI Immobilize cervical spine with collar or by holding head and neck in neutral alignment with body.
- With proper assistance and C-spine aligned or in collar, transfer patient to bed or stretcher.
- Treat bleeding lacerations.
- Document patient status, phone call to provider and provider’s response.

Focused Assessment
- Examine for lacerations, depressions, swelling, or Battle’s sign.
- Inspect mouth for blood, foreign bodies, and vomitus.
- Inspect pupils for equality and reactivity.
- Inspect ears and nose for leakage of clear fluid (CSF) suggestive of skull fracture.
- Assess for distal deficits such as numbness or paralysis in the arms or legs.
- Determine cause of fall and underlying conditions.
- Assess for history of seizures.
- Assess recent laboratory values.

Stabilizing and Monitoring
  - QI Immediate assessment of injuries; initiation of appropriate treatment and safety measures.
  - Continue to assess for impaired consciousness, deterioration in LOC, unequal pupils/decrease in reactivity, severe tachycardia or bradycardia—report changes in condition.
Assess for severe and persistent headache, nausea and vomiting, irritability, or altered behavior.
Assist with diagnostic procedures (x-ray or computed tomography [CT] scan).

**Be Prepared To**
- Set up and assist with intubation.
- Administer O₂ and monitor oxygen saturation (Sao₂).
- Monitor cardiac rhythm and VS.
- Assist with diagnostic testing.
- Insert an indwelling urinary catheter.
- Start an IV; administer IV fluids (IVF) and medications as ordered.
- Assist with immobilization of neck and back.
- Insert a nasogastric tube if necessary but only after basal skull fracture has been ruled out (to avoid introducing tube into the cranium).

**Possible Causes**
- Fall or other trauma.

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**Increasing ICP**

**The Patient May Have . . .**
- Subtle to dramatic changes in LOC; restlessness, confusion, drowsiness, stupor, coma; may occur over a few minutes, hours, or days.
- Double or blurred vision, throbbing headache, nausea and vomiting, sensitivity to light.
- Decreased motor function.
- Late findings: changes in VS (widening pulse pressure, bradycardia, hypertension [Cushing’s triad], and irregular respiratory rate), unilateral pupillary enlargement progressing to bilateral, decorticate or decerebrate posturing, responds only to painful stimuli to no response.

**Immediate Interventions**
- Assess airway patency, breathing pattern, and Sao₂.
- Assess VS and level of consciousness using GCS; compare with baselines.
  - Elevate head of bed 15° to 30°, and keep head in neutral alignment to promote venous drainage and avoid increasing ICP.
- Avoid flexion of the neck or hips, which will increase intracranial pressure.
Raise side rails to protect patient from injury.

**RI** Notify physician, PA, or NP of findings.
- Provide high-flow O₂ with a nonrebreather mask as ordered.
- Minimize environmental stimuli; stress stimulates the sympathetic nervous system, which constricts blood vessels and venous channels.
- Document patient’s status, phone call to provider, and provider’s response.

**Focused Assessment**
- Assess neurological status (see Rapid Neurological Assessment and GCS in this tab).
- Assess cranial nerves as condition allows (see Cranial Nerve Assessment in this tab).
- Observe for seizure activity.
- Assess SaO₂, cardiac rhythm, breathing patterns (breathing is often irregular when ICP is increased).
- Assess for signs of decreased oxygenation (desaturation, further decline in LOC, cyanosis, increased respiratory rate).
- Check blood glucose by fingerstick to rule out hypoglycemic cause of change in LOC.

**Stabilizing and Monitoring**
- Initiate work-up immediately; identify cause of change in LOC; maintain patient safety; support breathing/oxygenation; maintain cerebral perfusion pressure; transfer to appropriate level of care.
- Monitor neurological status and VS.
- Keep systolic BP between 100 and 160 mm Hg (check with physician for parameters).
- Limit suctioning (increases ICP); suction for fewer than 10 seconds in duration, and administer 100% O₂ beforehand; limit to two passes.
- Maintain SaO₂ at 100%.
- Maintain and assess I&O.
- Monitor arterial blood gases, electrolytes.
- If necessary, insert an oral or nasal airway.

**Be Prepared To**
- Assist with intubation if needed.
- Establish IV access, and give medications (sedatives, osmotic diuretics, corticosteroids, anticonvulsants, analgesics).

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- Insert nasogastric tube or urinary catheter.
- Transfer to ICU.

**Possible Causes**

- Tumor, cranial abscess, intracranial bleed, cerebral hypoxia, hypertension, hydrocephalus, head trauma.

**SEIZURE**

**The Patient May Have . . .**

- Partial seizure:
  - Aura (warning or recognition that seizure may occur).
  - Altered LOC or disorientation, staring.
  - Blinking or repetitive behaviors (e.g., playing with buttons).
  - Abnormal muscle contraction such as unusual head movements.
  - Paresthesias such as numbness or tingling feeling.
  - Auditory, visual, or olfactory hallucinations.

- Generalized tonic-clonic seizure.
  - Repetitive, jerking movements of the upper and lower extremities.
  - Extreme muscle rigidity.
  - Tongue or eye deviation.
  - Difficulty in arousing from stuporous state after seizure subsides (postictal).

**Immediate Interventions**

- Partial seizure
  - **SI** Stay with patient and protect him or her from harm.
  - Avoid touching the patient as they may instinctively struggle with you.
  - Remain with patient until full consciousness returns.
  - **QI** Provide information and reassurance.

- Generalized tonic-clonic seizure (grand mal seizure)
  - Note time of onset.
  - **SI** Ease patient to floor if he or she is out of bed and clear immediate area of potentially harmful objects (e.g., over-bed table or glasses).
  - If in bed, raise side rails.
  - **SI QI** Do not try to restrain patient or put anything in the mouth.
  - Stay with patient until seizure ends; note how long the seizure lasted.
Ascertain that airway is not compromised by secretions or emesis. Clear the mouth and suction if necessary. Turn head/body to side.

Ascertain that the patient is breathing; occasionally the patient will be apneic. With moderate vigor, shake the patient’s shoulder; this is often enough to end the apneic episode. Try again and call out the patient’s name but if that does not work, call a code.

STAT page physician if seizure lasts >5 min and is not subsiding, if the first seizure is quickly followed by another seizure, or if the patient sustained a head injury during the seizure.

Focused Assessment
- Assess VS, airway patency, and respiratory status.
- Note length, onset, duration, progression, and location (i.e., body parts involved) of seizure activity.
- Note tongue/eye deviation.
- Note LOC, orientation, and responsiveness during seizure.
- Assess pupil size, shape, and reactivity to light.
- Assess for incontinence.

Stabilizing and Monitoring
- Prevent injury during seizure; if new onset, initiate work-up; if history of seizures, evaluate current treatment plan.
- Notify physician, PA, or NP that the patient had a seizure.
- Complete assessment and document findings. Include seizure description: aura; onset; duration; body part in which seizure started and progression of seizure activity; LOC before, during, and after seizure; pupils; respiratory status; and any precipitating factors.
- Reorient patient if necessary.
- Allow patient to sleep. Keep side rails up until the patient is fully conscious.
- Provide reassurance and education.

Be Prepared To
- Start an IV, and administer antiseizure medications. Check blood levels of antiseizure medications.
- Prepare patient with new-onset seizures for extensive evaluation, including CT scan, electroencephalogram, lumbar puncture, glucose level, magnesium (Mg) level, calcium (Ca) level, complete blood count, electrolytes, blood urea nitrogen, and creatinine levels.
Possible Causes
- Inadequate blood levels of a prescribed anticonvulsant, arteriovenous malformation, stroke, infection, trauma, tumor, metabolic disorders (severe electrolyte disorders, low blood glucose level, renal failure, and hypoxia), drug or alcohol withdrawal.

Spinal Cord Trauma/Syndrome

The Patient May Have . . .
- History of recent back trauma with varying amounts of weakness and sensory loss at the level of and below the injury; pattern depends on whether cord injury is complete or partial (incomplete).
- Arm and/or leg weakness, paralysis.
- Breathing difficulties.
- Spasticity (increased muscle tone).
- Altered sensation, numbness, and/or pain.
- Loss of bowel and bladder control.
- Constipation, incontinence, bladder spasms.
- Rapid blood pressure fluctuations; abnormal sweating and thermoregulation (injuries to cervical or high thoracic cord).
- Loss of sensation, reflexes, and mobility below level of injury.
- Nausea and vomiting.
- Onset of symptoms may be gradual.

Immediate Interventions
- Immobilize cervical-spine (with light traction, hold head and neck in neutral alignment with body). Maintain spine in a neutral position, not flexed, extended, or rotated in any way. DO NOT try to move the patient alone. Summon help.
- If immobilizing entire body on a backboard, legs and torso must be secured before securing head to board.
- Assess airway, breathing, circulatory status.
- Assess VS, LOC, mental status.
- The time between injury and treatment can influence the degree of recovery; notify physician, PA, or NP for new onset of symptoms. Document phone call to provider and provider’s response.

Focused Assessment
- Assess mobility by asking patient to open and close fist, squeeze your hand, and move toes and turn feet (see Rapid Neurological Assessment in this tab).
Assess sensation by asking patient about numbness and altered sensation and by touching patient lightly, beginning at shoulder and working down arms and legs of both sides.

**Stabilizing and Monitoring**

- Prevent additional spinal injury and complications.
- Frequently assess motor or sensory function—call physician, PA, or NP immediately if condition changes.
- Assess VS, SaO₂, temperature.
- Assess for potential complications: neurogenic shock (hypothermia and hypotension without tachycardia), spinal shock (urinary and bowel retention leading to abdominal distention, ileus, and delayed gastric emptying), autonomic hyperreflexia, respiratory compromise, nutritional decline, skin breakdown, urinary retention, constipation.
- Maintain spinal stabilization and immobilization. Move the patient only with other staff and carefully using logroll technique. Use a spine board with restraints or other items, such as head blocks and pillows, to maintain position.
- Document findings, and communicate with physician, PA, or NP.
- Assist with diagnostic studies (spine x-rays, CT, magnetic resonance imaging [MRI]).

**Be Prepared To**

- Administer O₂ and monitor SaO₂.
- Set up and assist with intubation.
- Assist with placing patient in spinal traction.
- Monitor cardiac rhythm and VS.
- Assist with diagnostic testing.
- Insert an indwelling urinary catheter.
- Start an IV.
- Administer IVF and medications (e.g., methylprednisone).
- Assist with immobilization of neck and back.
- Insert a nasogastric tube.

**Possible Causes**

- Blunt or penetrating trauma, auto versus pedestrian, motor vehicle accident, spinal lesion or abscess.
**Sudden Neurological Deficit (Stroke/Transient Ischemic Attack)**

**The Patient May Have . . .**
- Weakness or numbness of one side of the face or body.
- Slurred speech, aphasia, difficulty finding words.
- Difficulty swallowing.
- Ataxia, clumsiness.
- Double vision, severe headache.
- Problems with respiratory function/gag reflex.
- Tachycardia/bradycardia/hypertension.
- Changes in affect/memory/judgment.
- Altered LOC, confusion, agitation, seizures.
- Nausea/vomiting.

**Immediate Interventions**
- If in bed, elevate head of bed 30° and position head to one side to prevent aspiration of secretions (if no signs of shock present). Raise side rails.
- Administer supplemental O₂.
- Assess VS.
- Do not give anything by mouth.
- Call physician, PA, or NP STAT.
- Stay with patient and provide reassurance.
- Document patient status, phone call to provider, and provider’s response.

**Focused Assessment**
- Assess airway, ability to clear secretions, breathing pattern, HR, cardiac rhythm, oxygenation status, and BP.
- Assess LOC (see GCS in this tab).
- If patient is conscious, assess his or her ability to speak by asking simple questions.
- Assess pupillary response, vision, and facial symmetry.
- Ask patient to move each extremity; assess grip strength in both hands to quickly assess for unilateral weakness.
- Note gaze deviation, if present.
- Note time of symptom onset if possible as treatment with thrombolitics must occur within 3 hours of stroke.
Stabilizing and Monitoring

**O1** Initiate treatment of stroke or transient ischemic attack; prevent injury related to new deficits; transfer patient to appropriate level of care.

- Reassess airway, ability to clear secretions, breathing pattern, HR, cardiac rhythm, oxygenation status, and BP every 15 minutes.
- Initiate seizure precautions.
- Suction the oropharynx as needed to clear secretions.
- Assist with diagnostic testing (CT scan, MRI, electrocardiogram).
- Monitor laboratory values, I&O.
- Administer medications as ordered.

**SI** Do not give anything by mouth until swallowing ability has been assessed.

- Stay with patient for continued monitoring and support.
- Support patient, and provide safe environment.

**Be Prepared To**

- Start an IV.
- Administer O₂.
- Draw laboratory tests.
- Accompany the patient to CT scan.
- Assess if patient meets thrombolytic criteria.
- Prepare patient for thrombolytic or anticoagulant therapy.
- Transfer patient to a higher level of care.

**Possible Causes**

- Embolic, thrombotic, or hemorrhagic stroke, TIA.
Rapid Renal/Fluid/Electrolyte Assessment

- A focused nursing assessment of renal function includes assessing blood work, urine tests, urinary characteristics and output, and a brief physical examination. Assessing voiding problems in most situations involves taking the patient’s history.

- **Assess blood urea nitrogen (BUN) level.**
  - BUN is a byproduct of protein metabolism and is excreted by the kidneys.
  - A rise in BUN reflects a decrease in kidney function (kidneys are less able to filter and excrete the urea). However, BUN is affected by other variables (e.g., dehydration, upper gastrointestinal [GI] bleed) and can remain within normal range even when kidney function is markedly impaired.
  - Therefore, creatinine is a better measure of renal function, and creatinine clearance is preferred among the three blood tests.
  - A rise in BUN without a rise in creatinine is most likely not related to a decline in renal functioning.
  - **Normal BUN value for adults:** 5–20 mg/dL.
  - **Critical level:** >40 mg/dL (patient not dehydrated/no history of renal disease).
  - **Critical level:** >100 mg/dL (patient with history of renal disease).
  - **Critical rise in BUN:** >20 mg/dL increase in 24 hr (indicates acute renal failure).

- **Assess creatinine level.**
  - Creatinine is a breakdown product of creatine phosphate in muscle.
  - It is generally produced at a constant rate by the body and then excreted by the kidney.
  - Creatinine levels are used to estimate glomerular filtration rate.
  - A rise in serum creatinine reflects a decrease in glomerular filtration rate (kidneys are less able to filter and excrete the creatinine; therefore, blood levels rise).
  - **Normal creatinine values for adults:** male, 0.6–1.2 mg/dL; female, 0.5–1.1 mg/dL.
  - **Critical level:** >4 mg/dL.

- **Assess creatinine clearance (CrCl):**
  - Compares the level of creatinine in urine with the serum creatinine level.
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- Used to determine safe dosing of nephrotoxic drugs.
- Requires a 24-hr urine collection and a blood sample at the end of the 24-hr period.
- Is often estimated using a formula based on age, mass, and serum creatinine.
- **Normal CrCl values:** male, 107–139 mL/min; female, 85–105 mL/min.
- **CrCl of 10–20 mL/min indicates renal failure and need for dialysis.**

### Assess urine, output, characteristics, and other characteristics.
- Urinalysis is the most common test and is used for screening.
- Urine osmolality and specific gravity are used to assess renal concentrating ability.
- Urine culture and sensitivity assesses for urinary tract infection (UTI).
- Urine output is a basic assessment of renal function and should be at least 30 mL/hr. If it falls lower, no matter what the cause, renal damage can occur.
- Urine characteristics (color, clarity, odor, volume) are routine daily assessments.
- Protein in the urine indicates glomerular disease.

### Assess for CVA tenderness.
- The angle created where the lowest ribs connect with the vertebral column is called the costovertebral angle (CVA). CVA pain and tenderness is associated with kidney problems.
- Ask about burning on urination and problems with flow, pain, and frequency.

### Assess hydration/fluid volume status.
- Assess input and output (I&O), daily weights, mucous membrane moistness, vital signs (VS).
- Check urine osmolality and specific gravity.
- Assess sodium levels, BUN-to-creatinine ratio, hemoglobin/hematocrit (Hgb/Hct).

### Assess electrolyte balance.
- Check basic chemistry profile for actual results.
- Signs and symptoms of electrolyte imbalance include:
  - Palpitations, hypotension.
  - Fatigue, muscle cramps or twitching.
  - Seizures, delirium, confusion.
  - See individual electrolytes for specifics.
Perform focused assessment of voiding problems.
- Assess voiding patterns, including stress, urge, or overflow incontinence and difficulties initiating stream.
- Palpate suprapubic area to assess for possible residual urine volume (urine remaining in the bladder after voiding or void attempt).
- Prostate enlargement interferes with voiding; prostate examination in males, which requires a digital rectal exam, is performed by a nurse practitioner (NP), physician’s assistant (PA), or physician.

Dehydration and Hypovolemia

- Dehydration and hypovolemia are sometimes used interchangeably, but they are not the same.
- **Dehydration** refers to a water deficit due to insufficient intake or excessive loss of watery fluids such as emesis or diarrhea. Sodium levels are always elevated in dehydration and treatment requires administration of free water.
- **Hypovolemia** refers to low blood volume. It is not the same as dehydration because blood has many more components than pure water. Sodium levels are either normal or low and treatment includes blood and/or saline-based infusions. See Shock in Emergencies tab for more information.

The Patient May Have . . .
- Weakness, dizziness, palpitations, hypothermia.
- Tachycardia, hypotension, diminished capillary refill time.
- Confusion, sluggishness, fainting, seizure.
- Decreased urine output.
- Increased thirst, dry mouth, and swollen tongue (see following table, Signs and Symptoms of Progressive Dehydration).

Immediate Interventions
- Assess VS; check blood pressure (BP) lying flat and standing, if possible; note changes.
- Assess urine output and recent daily I&O.
- Make sure patient is comfortable and safe; both dehydration and hypovolemia can cause light-headedness.
- Notify physician, PA, or NP.
- Document patient’s status, phone call to provider, and provider’s response.
Focused Assessment

- Assess recent laboratory values (electrolytes) and VS including temperature.
- Assess skin color, moistness, temperature.
- Inspect mucous membranes; note dryness.
- Assess level of consciousness (LOC) and orientation.
- Check for patent IV access.

Stabilizing and Monitoring

- **OI** Restoration of fluid volume, normal electrolyte levels, VS stable, normal sensorium.
  - Administer oral or intravenous fluids (IVF) as ordered.
  - Closely monitor I&O.
  - Monitor urine output for adequate hourly rate.
  - Assess electrolytes, BUN, creatinine.
- **SI** Maintain safe environment.
  - Provide oral care.
  - Chart patient status and convey to physician, PA, or NP.

Be Prepared To

- Obtain intravenous (IV) access and send blood for basic chemistries, blood glucose, and possibly complete blood count (CBC) and a coagulation profile if the patient is hypovolemic from blood loss.
- Send blood for calcium, magnesium, and phosphorus if the heart rate (HR) is irregular.
- Obtain a nutritional/dietary assessment.
- Insert urinary catheter with an urometer to monitor hourly output.

Possible Causes

- Gastroenteritis, stomatitis, diabetic ketoacidosis, febrile illness, pharyngitis, burns, GI obstruction, heat stroke, diabetes insipidus, thyrotoxicosis.
Electrolytes are chemical compounds that conduct electricity.
They break down into ions with either a positive or negative charge.
- Cations have a positive charge: sodium (Na\(^+\)), potassium (K\(^+\)), calcium (Ca\(^{2+}\)), magnesium (Mg\(^{2+}\)), and hydrogen (H\(^+\)) ions.
- Anions have a negative charge: chloride (Cl\(^-\)), bicarbonate (HCO\(_3^-\)), phosphate (HPO\(_4^{2-}\)), and sulfate (SO\(_4^{2-}\)) ions.
Abnormal levels of sodium, potassium, and calcium generally cause the most clinically important electrolyte problems.
Hyponatremia is the most common electrolyte imbalance.
See pp 99-100 for hyperkalemia, pp 102-103 for hypokalemia, pp 100-101 for hypernatremia, and pp 103-104 for hyponatremia.
Hypocalcemia: Ca <8.4 mg/dL

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>Treatment</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal and muscle cramps, lethargy, ↑ BP, tetany, seizure, electrocardiogram (ECG) changes.</td>
<td>Calcium gluconate 10%*: 1 gram in 50–100 mL of D5W over 1 hr, then infusion of 1–2 mg/kg/hr.</td>
<td>Given by physician, PA, or NP on general care units and by RNs in intensive care unit (ICU). Do not infuse too rapidly—is cardiotoxic and can cause ↓ BP. Never given intramuscularly or subcutaneously—causes severe sloughing of tissue. Check calcium and magnesium levels. Antidote: IV magnesium sulfate.</td>
</tr>
</tbody>
</table>

*Do not confuse with calcium chloride.

Hypercalcemia: Ca >10.2 mg/dL

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dehydration, renal stones, confusion, severe thirst, constipation, polyuria, shortening of QT interval, ↑ BP.</td>
<td>D5NS at 250–500 mL/hr. Furosemide 20–80 mg IV over 2 min to bring Ca down with diuresis.</td>
<td>Monitor electrolyte levels. Encourage fluid intake, provide ↑ fiber diet and stool softeners. Can potentiate digoxin toxicity; assess as indicated. Monitor ECG, if available, or assess pulse for irregular beats.</td>
</tr>
</tbody>
</table>
### Hypomagnesemia: Mg <1.5 mEq/L

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>Treatment</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weakness, vertigo, muscle twitching, tachycardia, seizures, tetany, premature ventricular contractions (PVCs).</td>
<td>2 g magnesium sulfate in D₅W over 10–20 min, then 1 g/hr for 3–4 hr.</td>
<td>Check other electrolyte levels; can have ↓ potassium, ↓ phosphate, ↓ calcium. Assess reflexes and monitor Mg levels.</td>
</tr>
</tbody>
</table>

### Hypermagnesemia: Mg >2.1 mEq/L

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>Treatment</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea, vomiting, ↓ BP, weakness, drowsiness, hyperreflexia, ↓ HR, coma, respiratory failure.</td>
<td>Calcium gluconate 10%*: 1–10 mL in 50–100 mL of D₅W over 10–20 min.</td>
<td>Assess for changes in LOC. Assess reflexes. Hold medications containing magnesium, especially in patients with renal failure.</td>
</tr>
</tbody>
</table>

*Do not confuse with calcium chloride.

### Hypophosphatemia: PO₄ <2.5 mg/dL

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>Treatment</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anorexia, weakness, muscle pain, confusion, rhabdomyolysis, hemolysis, cardiac and respiratory failure.</td>
<td>Potassium or sodium phosphate 2 mg/kg IV over 6 hr if PO₄ level is &lt;1.5 mg/dL. Oral replacement with K-Phos or Neutra-Phos if depletion is less severe.</td>
<td>Too rapid IV administration can cause severe hypocalcemia; assess for tetany.</td>
</tr>
</tbody>
</table>
Hyperphosphatemia: PO₄ >4.5 mg/dL

<table>
<thead>
<tr>
<th>Signs and Symptoms</th>
<th>Treatment</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited symptoms; possible tetany if calcium is low, which is a result of hyperphosphatemia.</td>
<td>Phosphate binders, possibly acetazolamide, low-phosphate diet.</td>
<td>Teach patient about avoiding foods and OTC medications high in phosphorus.</td>
</tr>
</tbody>
</table>

The Patient May Have . . .

- Muscle weakness, fatigue, palpitations, paresthesias.
- ECG abnormalities (tall, peaked T waves) and dysrhythmias.

Ranges of hyperkalemia:
- Mild: 5.1–6 mEq/L
- Moderate: 6.1–6.9 mEq/L
- Severe: >7 mEq/L

Immediate Interventions

- Assess VS; note cardiac rate and rhythm. The patient may have extra beats, pauses, or bradycardia.
- Assess for patent IV access.
- Assess recent laboratory results (BUN, creatinine, electrolytes, digoxin level).

RI Notify physician, PA, or NP. If potassium level is >7 mEq/L, call physician immediately if patient is asymptomatic and STAT if symptomatic (i.e., exhibiting cardiac rhythm disturbances).

Focused Assessment

- Monitor VS and cardiac rhythm.
- Assess LOC and orientation.
- Assess musculoskeletal function.
- Assess previous 2 days’ I&O.

Stabilizing and Monitoring

Qi Normalization of potassium level; decreased risk of cardiac arrest.

- Obtain IV access; place patient on cardiac monitoring.
Administer potassium-binding resins (Kayexalate) orally or rectally. Inform patient that this medication will cause diarrhea. Obtain bedside commode or bedpan and other supplies.

If the patient has a history of or new-onset renal failure, pharmacological therapy may not be sufficient, and he or she may undergo urgent dialysis. Prepare according to your facility's policy.

Monitor cardiac rhythm, I&O, serial potassium levels, and other laboratory tests.

Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**

- Set up cardiac monitoring.
- Administer IV calcium, sodium bicarbonate, insulin and glucose, or furosemide per order.
- Order or obtain laboratory tests.
- Order a 12-lead ECG.
- Transfer to telemetry unit or give report to dialysis unit.

**Possible Causes**

- Medication, chemotherapy, acute or chronic renal failure, hypoaldosteronism, trauma, hemolysis, digitalis poisoning, acidosis, burns, insulin deficiency, uncontrolled hyperglycemia, excessive use of salt substitutes, metabolic acidosis.

**Hypernatremia**

Hypernatremia may be acute, developing over <24 hr, or chronic, developing over >24 hr.

This is an important distinction as too rapid correction of chronic hypernatremia can cause cerebral edema, which can result in permanent neurological deficits or death from herniation.

**The Patient May Have . . .**

- Confusion, lethargy, seizures, coma (if imbalance is severe).
- Restlessness, irritability, disorientation, hallucinations.
- Thirst (many older adults have an impaired sense of thirst and may not express thirst), flushed skin, peripheral edema.
- Postural hypotension, tachycardia.

**Degrees of hypernatremia:**

- Mild: 146–155 mEq/L
- Moderate: 156–160 mEq/L
- Severe: ≥160 mEq/L
Immediate Interventions
■ Assess VS, hydration status, and neurological status.
■ Assess recent laboratory values. Determine, if possible, if elevations began in less than or more than the last 24 hr.
■ Notify physician, PA, or NP, document findings and discussion with provider in the chart.
   If sodium levels are >155 mEq/L, call physician immediately.
Focused Assessment
■ Assess total intake and output over previous several days.
■ Assess skin and mucous membranes; note dry, cracked skin and sticky oral membranes.
■ Assess mental status (see Mini-Mental Status Examination, pp 74-76).
■ Assess for intact IV site.
Stabilizing and Monitoring
OQ Safe normalization of sodium level; protection of patient’s physical safety until sensorium returns to baseline.
■ Insert IV if necessary.
   SI Administer parenteral fluids, as ordered, using a volume-control infusion device; make sure fluids do not infuse too quickly; doing so in the presence of elevated sodium levels causes fluid shifts that can result in cerebral edema and brain damage.
   SI If patient is disoriented, move patient to a room near the nurse’s station, obtain staff member to provide 1 on 1 care, or ask if a family member can stay with the patient.
■ Continue assessment outlined earlier as treatment progresses.
■ Provide mouth care and measures to protect skin integrity.
Be Prepared To
QI Change IVF as soon as a different concentration is ordered, depending on changes in patient’s status.
■ Monitor changes in mental status, laboratory values, VS.
Possible Causes
■ Poor water intake due to inability to express thirst, excessive insensible water loss, diabetes insipidus, excessive salt intake, near-drowning in salt water, medications, high-sodium tube feedings.
Hypokalemia

The Patient May Have . . .
- Palpitations, ventricular dysrhythmias, bradycardia or tachycardia, hypotension.
- Malaise, fatigue, weakness, muscle cramps.
- Nausea, vomiting, ileus, constipation.
- Hypoventilation, respiratory distress.
- Degrees of hypokalemia
  - Mild: 3.1–3.4 mEq/L.
  - Moderate: 2.6–3 mEq/L.
  - Severe: >2.5 mEq/L.

Immediate Interventions
- Assess HR; note rhythm.
- Assess LOC and muscle strength.
- Notify physician, PA, or NP. **If potassium level is <2.5 mEq/L, call physician.**
- Document patient’s status, phone call to provider, and provider’s response.

Focused Assessment
- Assess recent I&O.
- Assess cardiac rhythm if patient is on telemetry.
- Assess for digitalis toxicity if indicated.
- Assess recent laboratory results (BUN, creatinine, electrolytes, magnesium level [if magnesium is low, it will be difficult to raise potassium levels; coadministration of magnesium will be necessary]).
- Assess medication history, use of diuretics or laxatives.
- Assess for patent IV access.

Stabilizing and Monitoring
- **Safe normalization of potassium level, treatment of underlying cause.**
- Obtain IV access if potassium is <2.5 mEq/L.
- Administer oral and/or IV potassium supplement. **Oral supplementation is much safer; IV rate should not exceed 200–400 mEq/24 hr (based on serum potassium level of 2.0–2.5 mEq/L); never give as a bolus: may precipitate cardiac arrest.**
- Patient should be on telemetry if receiving treatment level amounts of potassium.
- Monitor potassium and other electrolyte levels.
- Monitor HR and heart rhythm.
- Nutrition/dietary education, especially if taking diuretics.
- Chart patient status and convey to physician, PA, or NP.
Be Prepared To
- Place patient on telemetry.
- Order or obtain laboratory tests, urine sample for potassium, ECG.

Possible Causes
- Deficient potassium intake, vomiting, diarrhea, fistulas, laxative abuse, metabolic alkalosis, diuretics, aldosteronism, renal tubule disease, chronic respiratory acidosis.

Hyponatremia

The Patient May Have . . .
- Nausea and vomiting.
- Headache, confusion, restlessness and irritability, seizures, coma.
- Loss of energy and fatigue.
- Muscle weakness, spasms, or cramps.
- Changes in neurological status, which usually reflect severe, sudden drop in serum sodium level. This causes intracerebral osmotic fluid shifts and cerebral edema.

- Degrees of hyponatremia:
  - Mild: Na⁺ <130–135 mEq/L: headache, nausea, vomiting, weakness, muscle cramps.
  - Moderate: Na⁺ 120–129 mEq/L: hallucinations, bizarre behavior, hyperventilation, gait disturbance.
  - Severe: Na⁺ <120 mEq/L: coma, respiratory arrest, hypertension, dilated pupils, seizures.

Immediate Interventions
- Assess VS, LOC, feelings of weakness.
- Make sure patient is comfortable and safe.
- Check if blood for laboratory test was drawn above a running IV site.
- Notify physician, PA, or NP immediately if sodium level is <120 mEq/L.
- Document patient’s status, phone call to provider, and provider’s response.

Focused Assessment
- Assess HR and BP lying, sitting, and standing (if possible); note changes in BP and HR.
- Assess fluid status: examine mucous membranes and skin turgor, assess lung sounds, check for peripheral edema.
- Assess recent I&O.
Assess for recent infusion of hypotonic IVF (common cause of ↓ Na⁺ in hospitalized patients) or use of continuous bladder irrigation.

Review medication and dietary history (salt and water intake).

**Stabilizing and Monitoring**

**Safe normalization of sodium level.**

- Treatment depends on patient’s volume status, duration and magnitude of hyponatremia, and severity of symptoms (see table on pp 105, Treatment for Mild or Moderate Hyponatremia).
- Monitor neurological status, laboratory values, I&O, VS.
- Restrict fluids, and administer diuretics or IVF as ordered.
- Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**

- Order or obtain laboratory tests (electrolytes, BUN, creatinine, urine and serum osmolality, urine sodium concentration).
- Obtain IV access.
- Administer oral or IV diuretics.
- Administer hypertonic saline solution IV if central nervous system (CNS) symptoms present. **Caution:** must be administered slowly via an infusion pump. Too rapid correction can cause permanent neurological impairment.

**Possible Causes**

- Vomiting, diarrhea, excessive sweating, GI fistulas or drainage tubes, pancreatitis, burns, acute or chronic renal insufficiency, medications (thiazide diuretics, chlorpropamide, cyclophosphamide, clofibrate, carbamazepine, oxcarbazepine, opiates, oxytocin, desmopressin, vincristine, selective serotonin reuptake inhibitors, trazodone, or tolbutamide), administration of hypotonic IV or irrigation fluids in the immediate postoperative period, prolonged exercise in a hot environment, hepatic cirrhosis, nephrotic syndrome, uncorrected hypothyroidism, cortisol deficiency, syndrome of inappropriate antidiuretic hormone (SIADH).

**Hypotonic Hyponatremia**

- Inability of the kidneys to excrete free water adequately.
- Categorized according to the associated intravascular volume: hypovolemic, hypervolemic, and euvoletic.
- Most common cause of hyponatremia is infusion of hypotonic fluids.
### Treatment for Mild or Moderate Hyponatremia

<table>
<thead>
<tr>
<th>Type</th>
<th>Cause</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypovolemic hyponatremia</td>
<td>↑ sympathetic tone, ↓ renal perfusion due to intravascular volume depletion leading to ↑ renin and angiotensin excretion, ↑ sodium absorption and resultant impairment of renal free water excretion. Increase in serum antidiuretic hormone (ADH) further impairs free water excretion.</td>
<td>Infuse 0.9% normal saline IV.</td>
</tr>
<tr>
<td>Euvolemic hyponatremia</td>
<td>Associated with SIADH arising from many clinical conditions including CNS disturbances, major surgery, trauma, pulmonary tumors, infection, stress, and certain medications (e.g., chlorpropamide, carbamazepine, cyclophosphamide, vincristine, vinblastine, amitriptyline, haloperidol, selective serotonin reuptake inhibitors, and monoamine oxidase inhibitors).</td>
<td>Treat underlying cause. Restrict free water.</td>
</tr>
<tr>
<td>Hypervolemic hyponatremia</td>
<td>↑ in total body water and sodium with paradoxical ↓ in circulating volume. Stimulates the same pathophysiological mechanism of impaired water excretion as is found in hypovolemic hypotonic hyponatremia. Also called dilutional hyponatremia.</td>
<td>Restrict free water. Possible diuretics.</td>
</tr>
</tbody>
</table>
Oliguria (Low Urine Output Acute Renal Failure/Acute Kidney Injury)

- Oliguria indicates a reduction in glomerular filtration rate or a mechanical obstruction to urine flow.
- Prerenal cause of oliguria means decreased blood flow to the kidneys; a renal cause means the kidneys are not filtering properly, postrenal cause indicates a mechanical obstruction.

The Patient May Have . . .
- Urine output <500 mL in 24 hr or <30 cc/hr for more than 2 hours.

Immediate Interventions
- Palpate bladder; if distended, check urinary drainage system for kinks or proper placement.
  - If distended but no urinary drainage system is in place, help patient use the commode. Note amount of urine voided and check for residual urine with bladder ultrasound.
  - If bladder is not distended, continue by assessing for decreased renal perfusion or renal injury.
- Assess BP sitting and standing (or lying flat and sitting up); note orthostasis.
- Assess HR, I&O for past 48 hours, baseline and current renal function tests (BUN/creatinine), and current electrolyte levels.
- Notify physician, PA, or NP of low urine output (or amount of residual urine if >100 mL) and your assessment.
- Document patient status, phone call to provider, and provider’s response.

Focused Assessment
- Assess for signs or symptoms of heart failure (jugular vein distention, peripheral edema, dyspnea on exertion/at rest/when lying flat, crackles at lung bases), which can cause decreased renal blood flow.
- Assess for potential causes of acute renal failure such as recent history of blood loss or dehydration, kidney injury, fever/possible sepsis, ingestion of nephrotoxic substances such as medications (antibiotics, ibuprofen, angiotensin-converting enzyme inhibitors, contrast) or poisons.

Stabilizing and Monitoring
- Identify cause of oliguria and initiate treatment promptly to prevent worsening condition.
- Insert IV access, and hang ordered IV fluids to reverse hypovolemia.
- Monitor I&O; assess for fluid overload.
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- Insert urinary catheter; monitor urine output hourly.
- Monitor BP, HR, capillary refill time, mental status.
- Chart patient status and convey to physician, PA, or NP.

**Be Prepared To**
- Administer IVF challenge.
- Obtain urine samples for analysis, culture, other studies.
- Obtain or order laboratory tests including BUN/creatinine, chemistries, CBC.
- Administer diuretics.
- Transfer patient to ICU if invasive monitoring is required.

**Possible Causes**
- Renal hypoperfusion (hypovolemia, congestive heart failure, sepsis, blood loss); renal arterial disease; acute glomerulonephritis; acute tubular necrosis; tubular, ureteral, or urethral obstruction; drugs (aminoglycosides, radiocontrast medium).

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**Urinary Retention**

**The Patient May Have . . .**
- Difficulty initiating stream, feeling of not emptying bladder.
- Inability to void.
- Lower abdominal pain, bladder distention, and spasm.
- Voiding in frequent, small amounts.

**Immediate Interventions**
- Palpate bladder to assess distention and tenderness.
- Assist patient to assume natural voiding position if possible (stand male patients, assist females to commode or raise head of bed when using bedpan).
- Implement triggers to help initiate stream (Credé’s maneuver, running water, pouring warm water over perineum).
- If patient still cannot empty bladder, check for as-needed (PRN) order to catheterize patient or obtain bladder US to assess amount of residual urine.
- If ordered, catheterize patient; note amount and characteristics of urine. Remove catheter. **SI: Note: Do not catheterize patient if suspected pelvic trauma or blood at meatus.**
- If patient does not have a straight catheter order or if residual volume is excessive (>500 mL), call physician, PA, or NP, and relate findings.
- Document patient status, phone call to provider and provider’s response.
Focused Assessment
■ Review patient history to determine possible cause of retention (recent abdominal surgery; medications known to cause retention such as antispasmodic, opioids, antidepressants and others; neuromuscular disease, back injury, prostate enlargement among others).
■ Assess temperature; recent white blood cell count, and urinalysis.
■ Assess voiding patterns, recent urological procedure or procedure requiring anesthesia, medications, history of benign prostatic hyperplasia (BPH), urethral stricture, history of incontinence.

Stabilizing and Monitoring

 Relief of acute urinary retention, identification of cause and treatment plan.
■ Monitor I&O.
■ Evaluate subsequent attempts to void and postvoid residual (PVR).
■ Chart patient status and convey to physician, PA, or NP.

Be Prepared To
■ Collect sterile urine sample.
■ Initiate timed voiding and obtain PVR until PVR <100 mL.
■ Place indwelling urinary catheter.
■ Teach self-intermittent catheterization.
■ Instruct patient about urodynamic testing.

Possible Causes
■ Obstruction in the bladder or urethra, neurogenic bladder (secondary to CVA, spinal trauma/tumor, multiple sclerosis, neuropathy), long period of inactivity or bedrest, surgery, low fluid intake, benign prostatic hyperplasia, kidney stones, UTI, medications including antihypertensives, antihistamines (can be OTC), anticholinergics, sedatives, spinal anesthesia.

Urinary Tract Infection

The Patient May Have . . .
■ Lower UTI signs and symptoms (cystitis):
  ■ Dysuria, frequency, urgency, hesitancy.
  ■ Cloudy, foul-smelling, or bloody urine.
  ■ Suprapubic pain.
  ■ Fever >101°F, chills, and malaise.
Upper UTI signs and symptoms (pyelonephritis):
- Fever >101°F, shaking chills.
- Nausea, vomiting, flank pain.
- Elderly: altered mental status, delirium, anorexia, abdominal pain, incontinence, or asymptomatic.

**Immediate Interventions**
- Assess VS.
- Notify physician, PA, or NP of symptoms.
- Obtain clean catheter urine specimen.
- Offer acetaminophen (if ordered) and heating pad or hot water bottle to relieve suprapubic pain.
- Encourage patient to drink fluids to flush urinary system.
- Document patient status, phone call to provider and provider’s response.

**Focused Assessment**
- Assess history of UTI and usual voiding patterns.
- Assess urine characteristics (odor, volume, color, cloudiness).
- Assess for flank pain.

**Stabilizing and Monitoring**
- Administer antibiotics promptly and on schedule.
- Administer phenazopyridine PRN for dysuria.
- Monitor temperature. Encourage fluids.
- Monitor for relief of symptoms or complications (urosepsis, onset of upper UTI symptoms).

**Be Prepared To**
- Insert saline lock for IV antibiotics for upper UTI.
- Administer IVF.
- Obtain catheterized urine sample.
- Change or discontinue indwelling urinary catheter.

**Possible Causes**
- Bacteria (usually *Escherichia coli*), factors that increase risk: incomplete emptying of bladder, neurogenic bladder; lack of adequate fluids; bowel incontinence; immobility or decreased mobility; indwelling urinary catheters.
Bladder and urethra. (A) Female. (B) Male.
Rapid Gastrointestinal Assessment

A rapid assessment of the gastrointestinal (GI) system includes evaluation of:

- Appetite, intake, and tolerance of foods and fluids.
- Swallowing.
- Abdominal pain, distention, bowel sounds.
- Nausea and vomiting.
- Frequency and character of bowel movements (constipation or diarrhea).

Assess appetite, intake, and tolerance of foods and fluids.
- If the patient complains of loss of appetite, ask when it began; if there is early satiety (feeling full after eating small quantities); and if there is nausea, vomiting, or weight loss.
- If general food intake is low, especially in older adults, assess dentition and ascertain whether foods have lost their taste to the patient.
- Does the patient tolerate the foods and fluids offered? If not, why not? Ask about food allergies.
- Decreased appetite is a symptom of many conditions, such as cancer, chronic obstructive pulmonary disease, esophageal problems, decline in acuity of taste buds, and others and must be promptly evaluated.

Assess swallowing.
- Note whether patient gags, coughs, or drools when eating. Any impairment in swallowing is serious and should be evaluated by a speech pathologist.
- Patients with impaired swallowing must sit upright to eat and are frequently allowed only liquids that have been thickened to a nectar, honey, or pudding-like consistency depending on degree of swallowing difficulty.

Assess abdominal pain.
- Ask the patient about the nature of the abdominal pain.
- Is it cramping and coming in waves (may indicate an obstruction)?
- Is it generalized discomfort (many possible explanations)?
- Is it sudden and severe (may indicate a perforated ulcer)?
- Is it accompanied by diarrhea, nausea, or vomiting?
- Use the patient’s words when you document the pain description.

Assess bowel sounds.
- Assess bowel sounds before palpating the abdomen.
- Normal bowel sounds are small gurgles heard every 5 to 15 seconds, although frequency can be less and still be normal.
Rapid, high-pitched, tinkling bowel sounds indicate increased pressure in the intestine and may be heard in the early stages of a bowel obstruction.

Hypoactive bowel sounds are gurgles heard infrequently, perhaps every 30 to 60 seconds.

Absence of bowel sounds (no sounds after several minutes) can indicate an inflammatory process such as peritonitis or a bowel obstruction.

Bowel sounds are absent after many surgeries and may take a few days to return. Patients are not fed when bowel sounds are absent, and a nasogastric tube (NGT) is usually in place to remove air and fluid.

When the patient passes flatus and bowel sounds return, it indicates that the intestinal tract is beginning to function again.

Assess abdominal distention.

The abdomen can be distended from constipation, excessive abdominal gas, severe bowel dysfunction, obstruction, or infection.

Distention is frequently associated with abnormal or absent bowel sounds.

Ascites, the abnormal accumulation of fluid in the peritoneal cavity, can cause massive distention. For patients with ascites, mark the abdomen and measure girth at the same level each day to assess whether ascites is decreasing or increasing.

Palpate or percuss the abdomen after listening to bowel sounds. Both skills take practice to be helpful in an assessment. Refer to an assessment textbook for more information.

Assess nausea and vomiting.

Ask what brings on the nausea; consider any recent procedures or new medication.

If the patient has vomited, assess quantity and characteristics of emesis.

Use a Hemoccult slide to test for blood in the emesis.

Fecal material in the emesis is rare but constitutes an emergency.

Assess frequency and character of bowel movements.

Ask about normal bowel habits and whether laxatives are used.

If the patient has diarrhea, ascertain the frequency and amount of stool. Diarrhea, especially accompanied by vomiting, can quickly cause electrolyte imbalances and dehydration.

If the patient is constipated, look to the recent history (procedures), medications that affect peristalsis (narcotics and many others),
nothing by mouth (NPO) status, or other possible causes. If constipation is chronic, discuss eating habits.

- Assess for black, tarry stools (melena). Test the stool for blood when GI bleeding is suspected.

## Abdominal Pain and/or Distention

Acute abdominal pain can be a symptom of mild, self-limiting illnesses to serious, life-threatening surgical emergencies. **RI** Pain with fever, prolonged vomiting, fainting, and/or evidence of GI bleeding represent the most serious presentations and must be investigated immediately.

### The Patient May Have . . .

- Abdominal pain with/or without tenderness; flank pain.
- Nausea, vomiting, diarrhea.
- Abdominal distention or rigidity.
- High-pitched, hyperactive, hypoactive, or absent bowel sounds.

### Immediate Interventions

- Place patient in position of comfort.
- If patient has an NGT but is unattached to suction, reconnect NGT to suction—note amount of immediate NGT drainage and whether pain and distention resolve.
- Assess vital signs including temperature.
- **SI** Do not administer as-needed (prn) laxative or enema until cause of pain has been established and use of these meds has been okayed by physician.

### Focused Assessment

- Ask patient to describe the character and location of the pain.
- Ask about timing of last normal bowel movement and recent laxative or enema use.
- Inspect abdomen; auscultate bowel sounds. (If the patient is connected to nasogastric suction, temporarily disconnect the tubing or turn off the suction while you listen for bowel sounds. Just clamping the tubing will not stop suction sounds.)
- Palpate abdomen for pulsations, tenderness, and rigidity. Assess from area of least tenderness to area of most tenderness.
- Assess for rebound tenderness in lower right quadrant, which is an indicator of appendicitis.
- Assess hydration status and urine output (UO) by reviewing input and output (I&O) record for previous 2 days.
- Check all recent laboratory values including complete blood count (CBC), amylase and lipase, liver function tests, if available.
Test emesis or stool for occult blood.

Notify physician, physician’s assistant (PA), or nurse practitioner (NP) of assessment findings. Document findings, phone call, and provider’s response.

**Stabilizing and Monitoring**

- Identify cause of pain and initiate treatment.
- Administer antiemetic and pain medication if ordered.
- Monitor vital signs (VS) as frequently as indicated.
- Assess output from NGT (if placed).
- Insert an intravenous (IV) line and hang 0.9% normal saline (with order).
- Clarify with physician, PA, or NP an alternative route for administration of oral medications.
- Obtain stool/emesis sample, and test for occult blood.

**Be Prepared To**

- Hang IV fluids.
- Administer pain medication, antiemetics, antibiotics.
- Insert an NGT, set up suction.
- Order or obtain laboratory tests.
- Facilitate diagnostic tests such as abdominal x-ray, computed tomography, endoscopy, ultrasound.

**Possible Causes**

- Bowel obstruction, ileus, peritonitis, irritable bowel syndrome, ascites, gastroenteritis, malignancy, liver disease, ulcers, appendicitis, cholecystitis, pancreatitis.

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**Constipation**

**The Patient May Have . . .**

- Complaints of constipation.
- Infrequent stools accompanied by discomfort, bloating, flatulence.

**Immediate Interventions**

- Assess bowel sounds, which may be infrequent; listen for a full minute before concluding that bowel sounds are absent.
  - If no bowel sounds are heard, do not administer laxatives or prn enemas; notify physician, PA, or NP with findings.
- Assess for abdominal distention and pain.
- Ask about last bowel movement and recent dietary intake.
- Check medication administration record (MAR) for medications that can cause constipation and for prn orders for laxatives and daily stool softener order.
If the patient has bowel sounds, is on a solid diet, and has a prn order for a laxative, check how soon the laxative is designed to work, and administer it at the appropriate time (e.g., some magnesium-containing laxatives work quickly; some are designed to work over 8 hr).

If there is an order for a small-volume enema that can be self-administered or an oral laxative, ask the patient which he or she prefers. Explain how to use the enema if the patient chooses that option.

**Focused Assessment**
- Reassess abdomen as indicated.
- Assess patient’s dietary intake especially for consumption of high-fiber foods.
- Assess effectiveness of laxative and return of usual bowel function.

**Stabilizing and Monitoring**
1. *QI* Relieve constipation and develop plan to prevent recurrence.
2. *QI* Review diet and medications for possible changes that can prevent or treat constipation.
3. *QI* Assess need for daily stool softener or bulk-forming laxative. Stimulant laxatives should be used infrequently.

**Be Prepared To**
- Check for impaction; administer saline enema.

**Possible Causes**
- Medications such as diuretics, loperamide, opioids, antidepressants, and medications containing iron, calcium, or aluminum; insufficient intake of dietary fiber; dehydration; hypothyroidism; hypokalemia; injury to the anal sphincter; diminished or absent peristalsis related to surgery, cancer, diverticula, irritable bowel syndrome, functional incapacity.

### Diarrhea

**The Patient May Have . . .**
- Frequent loose, watery, bowel movements.
- Loose stools containing blood, pus, or mucus.
- Abdominal pain, cramps, flatulence.
- Nausea, vomiting, dehydration.
- Fatigue, temperature elevation.

**Immediate Interventions**
- Assess VS and mental status.
- Provide comfort measures and perineal care.
Obtain stool samples.
Assess for patent IV access as patient may need fluid replacement if diarrhea is severe.
Notify physician, PA, or NP of symptoms.
Document patient status, phone call to provider and provider’s response.

**Focused Assessment**
- Assess hydration status (orthostasis, hypotension, and tachycardia; tissue turgor, mucous membrane moisture, mentation, UO).
- Assess recent GI history (onset, frequency and nature of stools, presence or absence of blood and mucus, vomiting, cramps, and fever).
- Assess recent antibiotic use, use of stool softeners and opiates (all associated with increased risk of pseudomembranous colitis [PMC] caused by *Clostridium difficile*. See Infection tab for more information about *C. difficile*).
- Ask about recently eaten meals (raw eggs, contaminated food, raw seafood) and travel history.
- Assess recent blood chemistries (electrolyte levels).

**Stabilizing and Monitoring**
- Prevent dehydration and electrolyte imbalance; initiate antimicrobial therapy promptly if indicated.
- Place patient on contact precautions in a single room if *C. difficile* suspected.
- Insert IV, and administer IVF (D5 ½ normal saline with KCl) if dehydrated or unable to tolerate oral fluids (with order).
- Encourage fluids if able to tolerate.
- Monitor I&O.
- Administer appropriate antibiotic/anti-infective agent promptly and on schedule.
- Avoid use of antimotility drugs (diphenoxylate, loperamide) or opiates if infectious diarrhea suspected.
- Monitor for relief of symptoms or complications (toxic megacolon if PMC, dehydration, electrolyte imbalance, skin breakdown).
- Document patient’s status in medical record, and communicate to physician, PA, or NP.

**Be Prepared To**
- Insert IV access and administer IVF.
- Obtain specimens.
- Implement contact precautions.
Possible Causes

- Viral, bacterial, or parasitic gastroenteritis; food-borne diarrhea; ulcerative colitis; Crohn's disease; AIDS; PMC; drug side effect; inflammatory bowel disease.

Feeding Tube Complications

Feeding tubes (FT) are a critical intervention for seriously ill patients or for those who cannot eat, whatever the underlying cause. However, they are not without risk and the patient must be closely monitored for complications. FT may be inserted through the nares or directly into the GI tract through the abdominal wall. See table for a description of feeding tube types.

<table>
<thead>
<tr>
<th>Types of Feeding Tubes</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasogastric (NG) feeding tube</td>
<td>Short-term feeding only for patients with a competent esophageal sphincter, no disorders of the stomach, and normal gastric motility. NG feeding tubes are irritating to patients, and a confused patient may actively try to remove it. If the tube has been pulled on but not removed, it greatly raises the risk of aspiration.</td>
</tr>
<tr>
<td>Nasojejunal (NJ) or nasoduodenal (ND) tube</td>
<td>Short-term feeding. Bypass the stomach when patients cannot tolerate gastric feeding or need to lie flat.</td>
</tr>
<tr>
<td>Gastric (gastrostomy tube, G-tube, or percutaneous endoscopic gastrostomy [PEG])</td>
<td>Inserted through the abdominal wall into the stomach for long-term use. For patients with a normally functioning GI tract.</td>
</tr>
<tr>
<td>Gastrojejunal (GJ-tube)</td>
<td>Long-term feeding for patients who cannot eat such as those with severe gastric motility problems, high risk of aspiration, or oral cancer.</td>
</tr>
<tr>
<td>Jejunal (jejunostomy, J-tube)</td>
<td>Long-term feeding for patients who cannot eat, such as those with severe gastric motility problems, high risk of aspiration, or oral cancer.</td>
</tr>
</tbody>
</table>
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The Patient May Have . . .
- An obstruction with feeding tube, i.e., feeding will not flow.
- Obvious displacement of feeding tube.
- Stomal infection (gastric or jejunal tubes).
- Fluid leaks from stoma (gastric or jejunal tubes).
- Fever and/or breathing problems.

Immediate Interventions
- Assess for leakage around insertion site.
- Assess for proper placement (is tube too far in tract, too far out, or completely out?).
- If tube is occluded, elevate head of bed (HOB) to minimize risk of aspiration and attempt to dislodge occlusion using method described in the following table.
- For complications or if attempt to dislodge tube is ineffective, notify physician, PA, or NP.
- Document patient status, phone call to provider, and provider’s response.

Focused Assessment
- Assess for signs and symptoms of aspiration (elevated temperature, increased respiratory rate diminished breath sounds).
- Assess level of consciousness (LOC)/mental status, if patient is pulling at tubing.
- Assess for signs and symptoms of infection (elevated temperature, pain, redness, warmth, purulent discharge).
- Assess hydration status.

Stabilizing and Monitoring
- See following table for guide to ongoing interventions.
- Monitor nutritional status.
- Provide stomal care.
- Obtain nutrition consult if indicated.
- Chart patient status and convey to physician, PA, or NP.

Be Prepared To
- Obtain replacement tube, and assist with bedside reinsertion.
- Obtain portable CXR for placement if nasogastric/nasoenteric tube is inserted.
- Resume tube feedings.
**Possible Causes**

- Varieties according to complication; see following table.

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### Preventing and Managing Gastric and Jejunal Feeding Tube Complications

<table>
<thead>
<tr>
<th>Complication/Cause</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leakage of gastric secretions:</strong> Improper positioning of patient, tube migration, stomal erosion or widening.</td>
<td>Position patient upright for feeding. Stabilize tube with gauze pads; adjust crosspiece. Keep skin around stoma clean and dry; use protective ointments and gauze.</td>
</tr>
<tr>
<td><strong>Tube migration:</strong> Internal balloon deflates or external tube suture, bumper, or disk falls out.</td>
<td>Reposition tube. Note length of tube outside of body, using either the external marks on the tube or a tape measure. Document length in nursing record, and measure each shift. Check that disk, suture, or attachment device is secure.</td>
</tr>
<tr>
<td><strong>Extubation:</strong> Internal balloon deflates or suture, bumper, or disk falls out.</td>
<td>Tract can close within a few hours. Feeding tubes must be replaced within a few hours.</td>
</tr>
<tr>
<td><strong>Stomal infection:</strong> Leakage around tube, inadequate stomal care, allergic reaction to soap.</td>
<td>Correct cause of leakage. Carefully clean and protect stoma per facility protocol. If stoma site is irritated, use plain water or change type of soap used.</td>
</tr>
<tr>
<td><strong>Gastroesophageal reflux/large residuals:</strong> Delayed gastric emptying.</td>
<td>Elevate patient’s head 30°–45° during feeding and for 1 hr after meal. Check residuals before feeding. Hold feeding if greater than 100 mL, and call physician, PA, or NP. Use gastric stimulant, if ordered, to promote gastric emptying. Consider continuous feeds or smaller, more frequent boluses.</td>
</tr>
</tbody>
</table>

*Continued*
Managing Feeding Tube Occlusions

**Prevention**

- Flush with 30 mL of water every 4–6 hr and **before and after** administering tube feedings, checking for residuals and administering medications.
- Use a feeding pump with an automatic water flush feature.
- Dilute liquid medications with 20–30 mL of water.

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### Preventing and Managing Gastric and Jejunal Feeding Tube Complications—cont’d

<table>
<thead>
<tr>
<th>Complication/Cause</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nausea, vomiting, cramps, bloating:</strong> Too rapid administration of feeding, lactose intolerance, fat malabsorption, contamination of food or feeding bag.</td>
<td>Change to a low-fat formula. Administer feeding at room temperature. Reduce rate of administration. Check residuals before bolus feeding or every 4 hr for continuous feeding. Hold feeding if greater than 125 mL; call physician, PA, or NP. Refrigerate open cans of formula, and keep only as long as manufacturer suggests. Clean tops of formula cans before opening. Hang only 4-hr amount of formula at a time. Clean feeding sets well, and replace per facility policy.</td>
</tr>
<tr>
<td><strong>Diarrhea:</strong> Too rapid increase in amount of feeding, too rapid administration, feeding too cold, lactose intolerance, tube migration from stomach to small intestine.</td>
<td>Add fiber, or use a formula with fiber. Reduce rate of administration. Administer feeding at room temperature. Do not add medication to formula. Retract tube to reposition against stomach wall.</td>
</tr>
</tbody>
</table>
Obtain all medications in liquid form. If liquid form is not available, check with pharmacist to see if medication can be crushed.

Administer each medication separately, and flush with 5–10 mL of water between each medication.

Do not mix medications with feeding formula.

**Management**

- Check the feeding tube for kinks.
- Inject a small amount of air into tube.
- Change patient’s position.
- If no obvious kink is found, place flushing syringe (30 mL) into the tube end, and gently pull back on the plunger to dislodge the occluding plug.
- If tube still blocked, instill warm water into the tube. Gently depress, and withdraw syringe plunger to remove obstruction. If unsuccessful, leave instilled warm water in tube, clamp tube for 10–15 min, and try again.
- Milk the tube with fingers from the insertion site out.
- **Do not instill meat tenderizer—can cause metabolic complications and allergic reactions.**
- Commercial products that use thin plastic devices for clearing feeding tubes or products that use a catheter and chemical declogging powder are available; however, a physician, PA, or NP usually must perform the procedure.
- To prevent tube damage, do not use force to unclog, or use a syringe smaller than 30 mL.

**Checking Feeding Tube Residuals**

- Assess every 4–6 hr or right before a bolus feeding.
- Use a 60-mL syringe and attempt to aspirate the feeding tube. Note how much fluid can be aspirated.
- Volume of <50 mL is normal.
- Volumes of 50–100 mL: recheck in 1 hr; if still above 50 mL, rate should be decreased.
- Volume >100 mL: stop feeding or do not administer bolus feed. Check residual every 2 hr until <50 mL, then resume continuous feedings at a lower rate or bolus feedings of smaller volumes.
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Hematemesis/Upper GI Bleed

The Patient May Have . . .
- Bright red or dark coffee ground–appearing emesis.
- Blood or coffeegrounds in NGT drainage.
- Distended, rigid, and/or tender abdomen.
- Nausea, black stools.
- Tachycardia, hypotension.
- Dizziness, weakness, shortness of breath (SOB).
- Anxiety.

Immediate Interventions

To prevent aspiration of blood and subsequent respiratory com-
promise, position patient to facilitate an open airway (upright or turned to
one side), particularly in patients who have inadequate gag reflexes or
altered LOC.

Differentiate that patient has vomited, not expectorated, blood.

- Vomiting blood is an emergency; STAT page physician.
- If patient has an NGT and you notice streaks of blood, it may be minor
irritation of the mucosa from the NGT; however, notify physician
promptly. Vomiting blood is an emergency; STAT page physician.

- Provide emesis basin.
- Assess blood pressure (BP), heart rate (HR), RR, temperature.
- Suction oropharynx if patient vomiting copious amounts and cannot
clear vomitus/secretions.
- Assess for patent IV. Obtain supplies to insert 2 IVs or hang IVFs.
- Document patient status, phone call to provider, and provider’s
response.

Focused Assessment

- Assess BP, HR, and RR. Check BP supine and standing (if feasible),
and document difference.
- Check oxygen saturation via pulse oximetry. Assess LOC.
- Assess skin color and temperature, capillary refill.
- Assess respiratory status and lung sounds.
- Assess abdomen for distention, tenderness, guarding, peristalsis,
and rigidity.
- Hematest emesis; assess amount and characteristics.
- Assess for use of anticoagulants, nonsteroidal anti-inflammatory
drugs (NSAIDs), or steroids.
- Check if patient has been previously typed and cross-matched and if
any blood products are available in the blood bank.
Stabilizing and Monitoring

Establish hemodynamic status and stability; if unstable, initiate all ordered procedures within your scope of practice, assist with physician-performed procedures, and prepare patient for immediate transfer to intensive care unit (ICU) or operating room (OR). For stable patients who do not require immediate ICU care, initiate more frequent monitoring of patient status, initiate any new procedures, and administer all newly ordered medications.

- Insert a large-bore IV, and administer IVF per order.
- Monitor VS frequently (every 5 min if unstable).
- Place an NG tube (per level of practice and physician’s order). Connect to low intermittent suction.
- Monitor laboratory studies (CBC, electrolytes, blood urea nitrogen [BUN], prothrombin time [PT]/partial thromboplastin time [PTT]/international normalize ratio [INR], arterial blood gases; type and cross-match).
- Insert a urinary catheter and monitor UO hourly (to assess renal perfusion).
- Monitor serial hemoglobin/hematocrit (Hgb/Hct).
- Provide oral hygiene and other comfort measures after episodes of vomiting.
- Chart patient status and convey to physician, PA, or NP.

Be Prepared To

- Start an IV (two large-bore IVs if vomiting copious amounts of blood).
- Assist with central line placement possible bedside endoscopy.
- Give IVF or blood products.
- Administer proton pump inhibitors (PPI) such as pantoprazole or esomeprazole.
- Set up gastric suction, and perform room-temperature saline lavage.
- Obtain/facilitate electrocardiogram, laboratory and diagnostic studies (x-ray, endoscopy).
- Prepare for ICU transfer if hemodynamically unstable.

Possible Causes

- Gastric ulcer, duodenal ulcer, gastric erosions, esophagitis, esophageal varices, Mallory-Weiss syndrome, carcinoma, peptic ulcer, polyps, salicylates, NSAIDs, corticosteroids, leukemia, uremia, blood dyscrasias, hemorrhagic gastritis.
Lower GI Bleed/Melena

The Patient May Have . . .
- Frankly bloody or melanotic stool or stool tests positive for occult blood.
- Abdominal cramping.
- Signs and symptoms of hypovolemic shock (acute bleed):
  - HR >110 beats/min; systolic BP (SBP) <100 mm Hg; orthostatic drop in SBP of >16 mmHg; oliguria; cold, clammy extremities; mental status changes.
- Anemia, fatigue, pallor, dizziness, chest pain (chronic bleed).

Immediate Interventions
- Use fecal occult blood tester to determine whether blood is present. Some foods and medications can make stools appear melanotic.
- Assess VS; check for orthostasis.
- **RI** Notify physician, PA, or NP. If bleeding is copious, STAT page physician.
- Document patient status, phone call to provider and provider’s response.

Focused Assessment
- Assess VS (HR, BP, RR, and temperature).
- Assess LOC and orientation; assess oxygen saturation.
- Assess skin color, moistness, and temperature; assess capillary refill.
- Assess abdomen (distention, tenderness, pain, bowel sounds).
- Obtain detailed GI history (history of tarry stools, use of NSAIDs, associated symptoms).
- Check recent CBC.
- Check if patient has been previously typed and cross-matched and if any blood products are available in blood bank.
- Assess for patent IV access.

Stabilizing and Monitoring
- **OI** Maintain hemodynamic stability; initiate treatment promptly. If patient is unstable and/or bleeding is profuse, perform all urgent/emergent procedures allowed within scope of practice and prepare to transfer patient to higher level of care.
- Monitor VS, hemodynamic status, and UO.
- Insert large-bore IV access.
- Record frequency and character of stools.
- Chart patient status and convey to physician, PA, or NP.
Be Prepared To
- Obtain or order laboratory tests, including coagulation studies (platelet count, PT, PTT, INR), electrolytes, BUN, creatinine, serial Hgb and Hct; type and cross-match.
- Start an IV, and administer IVF or blood products.
- Insert NGT, and check aspirate for blood; remove if negative.
- Prepare patient for or assist with anoscopy or colonoscopy.
- Insert a urinary catheter, and monitor UO.

Possible Causes
- Diverticulitis, GI polyps, anal fissures, hemorrhoids, ulcerative colitis, Crohn’s disease, ischemic colitis, upper GI bleed.

NAUSEA

The Patient May Have . . .
- Sensation/urge to vomit.
- Tachycardia, bradycardia.
- Diaphoresis, skin pallor.
- Decreased or high-pitched bowel sounds.
- Abdominal pain.

Immediate Interventions
- Elevate HOB to high Fowler’s position; provide emesis basin.
- Place weak, confused, or debilitated patient in a side-lying position to reduce risk of aspiration.
- Offer a cool compress to the forehead or nape of neck.
- Keep NPO.

Focused Assessment
- Assess patient’s ability to protect airway (is the patient awake and alert with an intact gag reflex and able to turn head).
- Assess VS.
- Assess for chest pain, SOB, headache, visual disturbances.
- Assess onset of symptoms and associated events (e.g., eating, medication, activity).
- Assess hydration status (orthostatic hypotension, skin turgor, mucous membranes, recent I&O).
- Assess for patent IV access.

Stabilizing and Monitoring
- Establish and treat cause of nausea, increase patient comfort.
- Determine if nausea is an anticipated side effect of treatment (anesthesia, chemotherapy).
Check MAR for prn antiemetic; administer if clinically indicated.
■ If nausea is not expected given the patient’s clinical problem, notify physician, PA, or NP.
■ Clarify whether to withhold PO medication or give by alternate route.
■ Monitor and record I&O.
■ Document patient status, phone call to provider and provider’s response.

**Be Prepared To**
- Administer antinausea medication as ordered.
- Start an IV, and give IVF for hydration.
- Monitor serial electrolytes, nutritional status, and UO.
- Facilitate diagnostic studies.
- Insert NGT if bowel obstruction is present.
- Call for an ECG if associated with chest pain; SOB; slow, fast, or irregular HR.

**Possible Causes**
- Gastroenteritis, appendicitis, bowel obstruction, other GI disorder, vascular headache, head injury, meningitis, other neurological cause, pregnancy, drug side effect, infection, pain, motion sickness, stress, chemotherapy.

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**Vomiting**

**The Patient May Have . . .**
- Small or large amounts of emesis.
- Tachycardia, bradycardia, diaphoresis, skin pallor.
- Abdominal pain, distention, decreased or high-pitched bowel sounds.

**Immediate Interventions**
- Elevate HOB to high Fowler's position; provide emesis basin.
- Place weak, confused, or debilitated patient in a side-lying position to reduce risk of aspiration.
- Offer a cool compress to the forehead or nape of neck.
- Keep NPO.

**Focused Assessment**
- Assess patient’s ability to protect airway (is he or she awake and alert with an intact gag reflex and able to move head).
- Assess VS.
- Assess for chest pain, SOB, or other symptoms (headache, dizziness, abdominal pain, diarrhea).
Assess onset of symptoms and associated events (e.g., eating, medication, activity).
Inspect emesis for color, odor, amount, and contents.
Assess abdomen for distention and tenderness.
Note if vomiting is projectile.
Assess hydration status (orthostatic hypotension, tissue turgor, mucous membranes, recent I&O).
Assess for patent IV access.

**Stabilizing and Monitoring**

- Relieve vomiting, prevent dehydration and electrolyte imbalance, improve patient comfort.
- Determine if vomiting is an anticipated side effect of treatment (anesthesia, chemotherapy).
- Check MAR for prn antiemetic; administer if clinically indicated.
- If vomiting is not expected given the patient’s clinical problem, notify physician, PA, or NP.

Clarify with physician, PA, or NP whether to withhold PO medication or give by alternate route.
- Monitor and record I&O.
- Administer IVF if ordered.
- Monitor laboratory tests for electrolyte imbalances (from loss of fluid) or metabolic alkalosis (from loss of gastric acid).
- Document patient status, response to treatment, phone call to provider and provider’s response.

**Be Prepared To**

- Start an IV, and give IVF for hydration.
- Facilitate diagnostic studies.
- Insert NGT if bowel obstructed or vomiting continues.
- Administer antinausea medication as ordered.
- Monitor serial electrolytes, nutritional status, and UO.
- Call for an ECG if associated with chest pain; SOB; slow, fast, or irregular heart rate.

**Possible Causes**

- Gastroenteritis, appendicitis, bowel obstruction, other GI disorders, vascular headache, head injury, meningitis, other neurological cause, pregnancy, drug side effect, infection, pain, motion sickness, stress, chemotherapy.
A & P Snapshot

Digestive System.
The endocrine system interacts with every cell in the body to maintain homeostasis. It consists primarily of several glands that secrete hormones; however, many organs, such as the kidneys and liver, have secondary endocrine functions. The main glands of the endocrine system (excluding the ovaries and testes) include the
- Hypothalamus.
- Pituitary.
- Thyroid and parathyroid glands.
- Adrenals.
- Pancreas.

Physical assessment of the endocrine system is difficult in that the thyroid is the only palpable gland and signs and symptoms can be vague or attributable to other causes.

Laboratory and diagnostic tests consist of radioimmunoassay of hormone levels, blood glucose levels, and other laboratory tests; 24-hour urine studies; and radiological scans.

Some physical signs and symptoms that may result from endocrine malfunction include:
- Change in appearance of hair, nails, and skin.
- Increased or decreased energy, insomnia, fatigue.
- Heat or cold intolerance, hypothermia, or fever.
- Tremors, tetany, muscle aches.
- Tachycardia, hypertension, or hypotension.
- Kidney stones, pathological fractures, muscle weakness, memory loss.
- Polyuria, polydipsia, polyphagia (excessive eating and drinking, excessive urination).
- Anorexia, weight gain or loss, constipation, dehydration.
- Change in thought processes, restlessness, agitation, confusion.

Most common endocrine disorders include diabetes mellitus (DM), hyperlipidemia, osteoporosis, hypo- or hyperthyroidism, and metabolic syndrome.

The endocrine glands produce many hormones, and many more are secreted by other organs. Major functions of the main glands and the major hormones of each are shown in the following table.
<table>
<thead>
<tr>
<th>Gland/Location</th>
<th>Function</th>
<th>Selected Hormones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothalamus: lower middle section of the brain</td>
<td>Link between endocrine and nervous system; &quot;master&quot; gland that stimulates pituitary.</td>
<td>Corticotropin-releasing hormone, Growth hormone–releasing hormone, Vasopressin (antidiuretic hormone [ADH]), Thyrotropin-releasing hormone</td>
</tr>
<tr>
<td>Pituitary: below the hypothalamus</td>
<td>Also called a master gland or &quot;executive&quot; of the hypothalamus. Anterior and posterior pituitary are different; both are connected to the hypothalamus.</td>
<td>Anterior pituitary: thyroid-stimulating hormone (TSH), Adrenocorticotropic hormone (ACTH), Posterior pituitary: vasopressin</td>
</tr>
<tr>
<td>Thyroid: in front and to the sides of the trachea</td>
<td>Controls metabolic rate—how fast cells create energy from food. Helps regulate calcium.</td>
<td>Thyroxine (T₄), Triiodothyronine (T₃), Calcitonin</td>
</tr>
<tr>
<td>Parathyroid: behind or next to the thyroid</td>
<td>Regulates blood calcium.</td>
<td>Parathyroid hormone (PTH)</td>
</tr>
<tr>
<td>Pancreas: behind the stomach</td>
<td>Controls glucose levels and produces digestive enzymes.</td>
<td>Insulin, Glucagon, Somatostatin</td>
</tr>
<tr>
<td>Adrenals: on top of each kidney</td>
<td>Cortex: affects salt and water balance, stress response, immune system, metabolism, sexual function. Medulla: fight-or-flight response; blood pressure regulation.</td>
<td>Glucocorticoids (cortisol), Mineralocorticoids (aldosterone), Androgens (testosterone), Adrenalin (epinephrine), Noradrenalin (norepinephrine)</td>
</tr>
</tbody>
</table>
Diabetic Ketoacidosis (DKA)

The Patient May Have . . .
- Blood glucose level of 250–800 mg/dL.
- Severe dehydration, tachycardia, and hypotension.
- Abnormal arterial blood gases (ABGs) indicating metabolic acidosis (pH <7.3, bicarbonate <18 mEq/L).
  - Mild DKA: pH 7.25–7.3; bicarbonate 15–18 mEq/L
  - Moderate DKA: pH 7.0–7.24; bicarbonate 10–14 mEq/L
  - Severe DKA: pH <7; bicarbonate <10 mEq/L
- Ketones in blood and urine.
- Multiple electrolyte abnormalities, including fluctuating potassium levels.
- Abdominal pain, nausea, and vomiting.
- Kussmaul’s respirations and fruity-smelling breath (somewhat like nail polish remover).
- No change in level of consciousness (LOC), mild confusion, lethargy, or coma.
- Recent history of excessive thirst and very frequent urination.
- Underlying infection or recent history of noncompliance with insulin therapy.

Immediate Interventions
- Assess vital signs (VS) and LOC. Double-check glucose level by taking a finger-stick sample.
  - If patient is obtunded and has difficulty protecting his or her airway, STAT page physician, suction oral secretions, elevate head of bed (HOB), obtain Ambu bag.
- Determine whether patient has a patent intravenous (IV) access as fluid replacement to correct dehydration is critical in the early management of DKA. Obtain liter bags of 0.9% saline.
- Notify physician, physician’s assistant (PA), or nurse practitioner (NP) of elevated glucose and other findings.
- Document findings, phone call to provider, and provider’s response.

Focused Assessment
- Continue to assess LOC and VS—hypotension can be severe.
  - Call provider immediately for subtle changes in LOC or drop in blood pressure.
- Assess for signs and symptoms of infection.
- Assess ABG results.
- Assess most recent electrolyte values, ketones, and osmolality, if available.
Stabilizing and Monitoring

Correction of fluid deficit; decreased blood glucose to target level (100–150 mg/dL); correction of acidosis, ketosis, and electrolyte abnormalities; identification and treatment of underlying cause.

- Insert large-bore IV if there is no IV access and hang IV fluids (0.9% saline, Ringer’s, or Normosol) with order. Monitor IVF carefully; rates in the first hour may be as high as 1000 mL/hour to 1500 mL/hour.
- Hang a continuous infusion of short-acting (regular) insulin in a separate IV site per facility’s DKA protocol. Insulin is a high-alert medication. Have another nurse double-check the order, the dosage calculations, and programming of infusion pump.
- Determine whether patient uses an insulin pump for daily glucose control and stop it while on insulin drip.
- Monitor VS and LOC frequently.
- Administer electrolyte supplements as ordered.
- Monitor repeat blood glucose electrolytes, and ABGs, which should be assessed every 1 to 2 hr until the patient is stable and then every 4 to 6 hr.
- Monitor input and output (I&O).

Be Prepared To

- Obtain serum glucose and electrolyte levels, complete blood count (CBC), blood urea nitrogen (BUN) and creatinine, ketones or beta-hydroxybutyrate levels, ABGs; electrocardiogram (ECG); chest x-ray; and blood, urine, or sputum cultures.
- Send patient for brain computed tomography or magnetic resonance imaging, if mental status is altered, to assess for cerebral edema.
- Transfer patient to intensive care unit (ICU).

Possible Causes

- An infection in an otherwise well-controlled diabetic patient or other underlying medical illness; too little insulin or failure to take any insulin; new onset of diabetes.
Hyperosmolar Hyperglycemic State (HHS)

**The Patient May Have . . .**
- Serum glucose >600 mg/dL, serum osmolality ≥320 mOsm/kg (the higher the osmolality, the greater the impairment of LOC).
- Profound dehydration.
- pH >7.30; bicarbonate >15 mEq/L.
- Change in mental status including confusion, delirium, lethargy, drowsiness coma.
- Blood and urine samples negative for ketones (distinguishes HHS from DKA).
- Focal or generalized seizures.
- Hypotension, tachycardia.

**Immediate Interventions**
- Call physician, PA, or NP as soon as the serum glucose level is known or if the patient's LOC has changed.
- If patient's LOC is declining from drowsiness to stupor or coma (which can happen rather quickly), assess ability to protect airway and call physician STAT. Raise HOB, suction oral secretions, obtain Ambu bag and oxygen administration setup.
- Assess VS and note any signs or symptoms of an underlying illness such as infection. Assess temperature rectally.
- Check for a patent IV access; if none, gather needed supplies for IV insertion. Take normal saline to keep the vein open (with order) until treatment-level IV orders are written.

**Focused Assessment**
- Evaluate the degree of dehydration by assessing skin turgor, mucus membranes, orthostatic blood pressure, hourly urinary output, and BUN and creatinine levels.
- Check ABGs as frequently as indicated, possibly every 15 min. Assess LOC at the same time. Note shallow, rapid respirations.
- Monitor BP; shock can develop quickly. Assess for orthostasis (drop in systolic BP >10 mm Hg when position changes from lying to standing or lying to sitting upright if standing is not possible).
- Assess HR apically or with ECG monitoring if available. Note dysrhythmias, tachycardia.
- Check serum chemistries for hypokalemia, ↑BUN, ↑serum osmolality (>350 mOsm/L), and CBC for elevated hemoglobin/hematocrit (from dehydration) as well as elevated white blood cell count.
- Assess for focal neurological changes, including aphasia and hemiparesis, which can resemble signs of stroke.
Assess for history of type 2 diabetes.
Assess for underlying illness that triggered HHS.

Stabilizing and Monitoring
- Rehydration, correction of hyperglycemia and electrolyte abnormalities, identification and treatment of underlying illness.
- Recheck blood glucose hourly until stable.
- Monitor neurological status carefully; HHS may trigger seizures and/or decline in mental status.
- Monitor respiratory function; acute respiratory distress syndrome (ARDS) is a documented complication of HHS.
- Increased blood viscosity due to severe dehydration can cause thromboembolism. Monitor closely for signs/symptoms of cerebral, pulmonary, mesenteric, or coronary embolism. Discuss use of low dose heparin with physician, PA, or NP if not already ordered.
- Insert large bore IV access and hang IVF, initially 0.9% saline, as ordered.
- Monitor serum chemistries, and replace electrolytes as ordered.
- Serum potassium levels may fall quickly with rehydration and should be assessed every 4 hours until patient’s condition has stabilized.
- Initiate subcutaneous low-dose heparin when ordered. Assess for signs or symptoms of venous thrombosis. (Due to dehydration, blood becomes hyperosmotic, meaning the blood is very thick. This predisposes the patient to thrombosis.)
- Assess coagulation studies for signs of disseminated intravascular coagulation (DIC), a complication of HHS.

Be Prepared To
- Obtain ABGs, blood- or finger-stick glucose levels.
- Administer IV insulin. Insulin is a high-alert medication; have second practitioner double-check orders, calculations, and programming of infusion controller/pump.
- Facilitate blood tests and other diagnostic tests.
- Assist with insertion of a central venous catheter.
- Transfer to ICU.

Possible Causes
- Preceding or concomitant illness that triggers dehydration (pneumonia and urinary tract infection are common triggers); stress response to illness that raises glucose levels; drugs that raise glucose levels, inhibit insulin, or cause dehydration.
Hypoglycemia

The Patient May Have . . . .
- Cool, pale, and diaphoretic skin.
- Agitation, disorientation, slurred speech, blank stare.
- Headache, palpitations/tachycardia, trembling, hunger.
- ↓LOC progressing to coma and/or seizures if not treated.

Immediate Interventions
- Obtain a blood glucose level by finger stick.
- Assess VS and LOC.

**SI** If patient is unresponsive, position to protect airway and call physician, PA, or NP STAT. Obtain IV access and administer 1 amp (25 g in 50 mL) of 50% dextrose IV (over 1 min) (with order). If IV access cannot be obtained, administer 1 mg of glucagon IM.
- If patient is alert, give 10 to 15 grams of oral, rapidly absorbed carbohydrates (4 oz of soda or juice, 4 teaspoons of sugar or honey, 4 lifesavers, 8 oz nonfat or 1% milk) and recheck finger-stick glucose in 10 min.
- If glucose is now >70 mg/dL, monitor patient closely and provide a snack or meal within 30 min. Document episode and patient’s status.
- If glucose level is still <70 mg/dL, give another 10 to 15 grams of carbohydrate. Recheck finger-stick glucose in 10 min; if glucose is still <70 mg/dL, notify physician, PA, or NP immediately.
- Document patient status and glucose level after IV administration of glucose or oral intake. Include phone call to provider and provider’s response.

Focused Assessment
- Assess time the insulin or oral hypoglycemic agent was taken and amount.

**QI** Ascertain that dose/type of insulin/oral hypoglycemic given was accurate.
- Assess whether patient has eaten.
- Assess other medications for potential to affect glucose control.
- Assess response to oral or IV administration of glucose.
- Assess for concomitant illness, particularly infections.

Stabilizing and Monitoring

**QI** Quickly raise blood glucose levels to normal to prevent neurological injury.
- Repeat serum glucose test, and reevaluate patient as needed until glucose level is stable.

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Once symptoms improve, provide more slowly absorbed carbohydrates (e.g., milk, crackers).
Consult dietitian/nutrition support.
Monitor for hypokalemia.
Reassess insulin dosages with team.
Chart patient status, and convey to physician, PA, or NP.

Be Prepared To
- Start a peripheral IV.
- Administer glucagon or other medications if necessary.
- Obtain serial blood glucose levels.
- Assist with airway management and intubation if needed.
- Manage seizure activity if necessary.

Possible Causes
- Diabetic patients: overdose of insulin or oral hypoglycemic agent, increased activity, too little food intake, alcohol, drugs, emotional stress, infections; nondiabetic patients: liver disease, excessive alcohol consumption, drug reaction (beta-adrenergic blockers and sulfonylureas are most common).

Myxedema Crisis/Coma

The Patient May Have . . .
- Low body temperature, cold intolerance.
- Confusion, depression.
- Bradycardia, hypotension.
- Hypoventilation, hypoxia.
- Weakness.
- Edema, hyponatremia.

Immediate Interventions
- Assess LOC (see Glasgow Coma Scale in Neuro tab).
- Assess VS, and ability to protect airway. Position to protect airway.
- Assess for a patent IV access.
- Provide blankets (not a warming blanket—can cause vasodilation and lower BP even further).
- Call physician, PA, or NP; document phone call and response.

Focused Assessment
- Assess laboratory values—may have low sodium, low glucose, low calcium, high creatinine phosphokinase, and high creatinine. Free T4 and T3 levels will be low or undetectable.
Assess respiratory pattern and ABGs; may have ↓pH, ↓O_2 saturation, with ↑carbon dioxide (respiratory acidosis).

Assess for underlying illness, particularly infections and septicemia.

Assess for recent discontinuation of thyroid supplements.

Assess for other signs and symptoms of hypothyroidism:
  - Altered mentation, such as apathy, confusion, psychosis, or coma.
  - Alopecia; coarse, sparse hair.
  - Dry, cool, skin.
  - Elevated diastolic BP in early stages; hypotension later.
  - Bradycardia.
  - Decreased GI motility, abdominal distention, myxedema megacolon (late).
  - Low temperature.
  - Generalized facial swelling, ptosis, periorbital edema.

**Stabilizing and Monitoring**

- Thyroid hormone replacement, cardiovascular and respiratory support.

- Continued assessment of cardiac rhythm as heart block, bundle branch block, and bradycardia may occur.

- Monitor respiratory status. Implement aspiration precautions.

**RI** If respiratory acidosis/hypercapnia/hypoxia are significant, suggest mechanical ventilation.

- Administer IV thyroid hormone replacement, cortisol, or electrolytes as ordered.

- Provide blankets.

**Be Prepared To**

- Assist with obtaining laboratory studies, inserting and hanging IVF, administering medications as appropriate to the unit.

- Transfer patient to ICU.

**Possible Causes**

- New infection in an otherwise well-controlled hypothyroid patient; medications such as diuretics, opioids, beta blockers, tranquilizers, and others in a hypothyroid patient; gastrointestinal bleed; stroke; surgery; trauma.
Thyroid Storm (Thyrotoxic Crisis)

The Patient May Have . . .

- Tachycardia, palpitations, hypertension, widened pulse pressure, atrial fibrillation.
- Anxiety, irritability, restlessness to unresponsiveness, seizure.
- Elevated T4, low TSH.
- Shortness of breath, chest pain.
- Vomiting, diarrhea.
- Warm, flushed skin, high fever (105°–106°F), profuse sweating.

Immediate Interventions

- Assess VS, cardiac rhythm.
- Assess LOC and ability to protect airway.
- If signs of shock or decreased LOC are present, notify physician STAT.
- Check O2 saturation by pulse oximetry. Provide supplemental O2 if indicated.
- Assess for patent IV access.
- Call physician, PA, or NP with findings. Document phone call and response.

Focused Assessment

- Continued assessment of cardiac, respiratory, and neurological status.
- Assess for signs and symptoms of heart failure.
- Assess electrolyte levels, if recent ones are available.
- Assess for triggering events such as sepsis, excessive intake of thyroid hormone, or direct trauma to the thyroid gland.
- Assess for signs and symptoms consistent with hyperthyroidism:
  - Edematous legs and feet.
  - Intolerance to heat; increased sweating.
  - Labile mood, possible psychosis.
  - Exophthalmia (bulging eyeballs).
  - Weakness.
  - Pretibial myxedema—itchy lesions on the legs and feet (not to be confused with myxedema as seen in hypothyroidism).

Stabilizing and Monitoring

- Control hyperthermia, correct hyperthyroid state, prevent complications.
- Continue frequent assessments.
- Insert IV if no access; hang IVF.
- Administer electrolytes as ordered. Assess calcium levels as hypercalcemia may occur.
- Administer medications such as propylthiouracil (PTU) or methimazole (Tapazole) as ordered. PTU can cause acute liver failure and death; other medications are preferred; if given, monitor closely for liver failure or methimazole to control $T_4$ production, hydrocortisone, and propranolol to control signs and symptoms.
- Reduce fever with acetaminophen, cooling blanket, ice packs, and/or tepid baths if needed.

**Be Prepared To**
- Assess glucose level; obtain other laboratory values.
- Transfer patient to ICU.

**Possible Causes**
- Lung infections, discontinuing hyperthyroid medications, excessive dose of thyroid replacement medications, thyroid surgery in patients with overactive thyroid gland.
The endocrine system.
A rapid musculoskeletal system assessment should be done on all patients who have been immobilized or on bedrest for more than a few days and especially on older patients and those with an orthopedic problem, recent trauma, arthritis, neurological problem (e.g., stroke), or neuromuscular disease.

- Assess the peripheral nervous system simultaneously.
- Assessment of musculoskeletal status includes assessment of:
  - Muscle strength, joint mobility, and range of motion (ROM).
  - Neurovascular status of extremities (assessment of circulation, motion, and sensation).
  - Ability to ambulate and whether assistive device is needed.
  - Pain.
  - Fall risk.

**Strength, joint mobility, and range of motion (ROM).**

- The most basic assessment is to ask the patient if he or she can move all four extremities. Note if there is decreased ability to move a specific extremity or both extremities on one side. See Rapid Neurological Assessment tab for more details.
- To assess strength, have the patient raise or push an extremity against your hand as you exert resistance.
- Assess all four extremities and note disparities in strength from side to side.
- Ask patient to put shoulders, elbows, wrists and fingers, hips, knees, and ankles through full range of joint motion as indicated. Neck and back can be included if appropriate. Note joints with limited ROM or pain with movement.
- If the patient cannot independently move an extremity, perform passive range of motion (PROM) in which you move the joint through its normal ROM. **Do not push a joint past its range even if that range is quite limited.**
- Do not push the joint if the patient has pain.

**Neurovascular status** (sometimes abbreviated as CMS for Circulation, Motion, Sensation).

- Circulation: palpate peripheral pulses and check capillary refill time.
- Note color of extremity; compare with opposite extremity.
- Motion: have patient move hands and fingers, flex and extend feet. Focus on the extremity of interest, but initially compare with the contralateral (opposite) arm, hand, leg, or foot.
Sensation: ask about paresthesias (numbness and tingling, odd sensations); lightly trace your finger over different surfaces of the at-risk area to assess sensation. Have the patient close his or her eyes while you do this.

Ambulatory status.
- You should know from the history whether or not the patient ambulated independently before admission to the hospital. Assess if there has been a change from baseline.
- Assess need for assistive devices. If the patient uses an assistive device, assess whether he or she is using it safely.

Pain.
- Ask patient if he or she is in pain and to describe the location and characteristics of the pain. Using a scale of 0 to 10, ask what level of pain the patient currently is experiencing. (See Pain Assessment in Tools tab.)
- Note if current pain is new since admission to the hospital or if it is similar in intensity and quality to preadmission pain.
- Determine what has worked to alleviate the pain in the past.
- Using a scale of 0 to 10, ask the patient how distressed he or she is by the current pain.
- Ask at what level he or she usually takes pain medication.
- Ask about the current pain control regimen and if it is satisfactory.

Fall risk.
- Your facility should have its own fall risk assessment tool. Use on all patients, not just those with an obvious risk.
- The main factors assessed include level of consciousness (LOC); past history of falls; ambulatory status; balance; postural blood pressure (BP) changes (i.e., BP drops with standing up); certain diseases and medications; and use of hospital apparatus such as tubing, suction setups, intravenous (IV) poles, etc., that may interfere with mobility.

Rapid Skin Assessment
- Assess skin integrity each shift for patients at risk for skin breakdown and patients with incisions, pressure ulcers, or wounds.
- Assessment of skin integrity includes:
  - Skin condition.
  - Surgical or traumatic wounds.
  - Bandages, casts, wound dressings, and drainage systems.
  - Pressure points.
  - Pressure ulcers.
Skin condition.
- Note if skin is dry, moist, abraded, or fragile. Note any lesions, blisters, discoloration or other abnormality.
- Assess for skin tears, which are common in older patients, and other disruptions in skin integrity such as surgical incisions.

Surgical or traumatic wounds.
- If dressings are not to be removed, assess for bleeding or drainage on dressings, intactness of dressings, and any tubes or drains exiting from the periwound area.
- When changing the dressing, assess for sutures, staples, drainage, swelling, or signs of infection.
- Assess for skin problems related to bandaging. For example, tape covering a postoperative dressing can cause skin maceration and blistering, especially when the site swells after the dressing was applied.

Bandages, casts, wound dressings, and drainage systems.
- Assess for signs of skin breakdown from casts, bandages, dressings and tubing. Be extra vigilant if the patient is diabetic because of decreased circulation and possible nerve damage that interferes with sensation (diabetic neuropathy).
- Casts and circular dressings can abrade skin and impair circulation. Assess the tightness of these dressings, which can become irritating and injurious.

Pressure points.
- Assess pressure points; do not massage reddened areas.
- Use position changes, pillows, and preventive mattresses to alleviate pressure.

Pressure ulcers.
- Perform a thorough wound assessment including wound stage (see Pressure Ulcer later in this tab).
- Assess healing and describe signs of healing (e.g., presence of granulation tissue, decreased circumference of wound edges).

Compartment Syndrome

- Muscle groups are covered with a tough, inelastic tissue called fascia. This envelope of tissue creates a compartment that contains the muscles, nerves, veins, and arteries.
- After injury or surgery, swelling of the muscles causes increased pressure in the fascial compartment because the fascia cannot
expand. The pressure closes off capillaries, arterioles, and eventually arteries, resulting in ischemia that will progress to necrosis if not treated.

- Compartment syndrome is more common in the extremities, particularly the anterior or posterior compartments of the lower leg, but it is possible at other sites of injury such as the abdomen. This discussion is focused on the arm or leg.

The Patient May Have . . .

- Severe pain not relieved by opioid analgesics and unusual for the injury. The pain worsens with stretching of the involved muscles. This pain is the first symptom to appear. Once other signs are evident, the process is well established, and tissue damage is probable.
- Pallor—palleness of the involved extremity.
- Pulselessness—loss of pulses or markedly diminished pulses of the affected extremity.
- Paresthesia—numbness and tingling.
- Paralysis—loss of ability to move the extremity.
- Diminished capillary refill time (>3 sec).

Immediate Interventions

- Extreme pain is the first warning sign. When pain is more severe than expected, immediately consider compartment syndrome, and notify physician, physician’s assistant (PA), or nurse practitioner (NP).
- Although pain medication should not be delayed or withheld, do not simply medicate and return later to see if the medication is working; stay with the patient, and perform a focused assessment.
- Elevate the extremity to the level of the heart to prevent further swelling and increase venous return.
- Palpate pulses. Use a Doppler if not palpable.
- Do not put ice bags on the extremity.
- Document phone call to provider and provider response.

Focused Assessment

- Note skin color and if pallor is present.
- Blanch the skin, and check capillary refill time.
- Assess nerves in the affected extremity for altered sensation or impaired mobility.

Stabilizing and Monitoring

- Early recognition of syndrome; urgent surgical intervention to prevent complications.
Continue to monitor vascular status. Pain indicates ischemia, but if pallor or pulselessness develops, tissue necrosis and permanent damage will occur.

Remain with patient until the provider arrives. Loss of pulses and/or the extreme pain that accompanies compartment syndrome constitute a surgical emergency. The provider must rapidly determine the treatment plan and if immediate surgery is necessary.

**Be Prepared To**

- Assist with pressure measurements of the affected compartment.
- Get the patient ready for an emergency fasciotomy in the operating room: draw blood, start an intravenous (IV) line, etc. Make sure the time of the patient’s last meal or fluids is documented and easy to find.

**Possible Causes**

- Severe muscle injury, burns, fractures.

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### Hip Fracture

**The Patient May Have . . .**

- Groin, knee, or hip pain.
- Inability to bear weight on affected extremity.
- Shortened and externally rotated leg.
- Inability to move affected leg.

**Immediate Interventions**

- Do not move leg; allow patient to maintain position of comfort.
- Inspect and palpate for deformity, hematoma, laceration, and asymmetry.
- Call four to six staff members to help transfer patient from stretcher to bed or, if patient has fallen, to lift patient into bed.
- Assess vital signs (VS); assess for patent IV access.
- Call physician, PA, or NP; document phone call and provider’s response.

**Focused Assessment**

- If patient has experienced trauma, perform a primary survey and stabilize airway, breathing, and circulation (ABC). Then perform a secondary survey to detect associated injuries.
- Assess VS, and observe for signs and symptoms of shock such as cool, clammy skin; mental status changes; and decreased urine output (blood loss from hip fracture can be as much as 1,500 mL).
- Assess VS, LOC, and orientation.
Inspect affected leg for shortening and rotation compared with the opposite leg.

Do not assess ROM unless x-ray is negative.

Assess distal circulation, sensation, and ability to move toes.

**Stabilizing and Monitoring**

- Prevent further injury; relieve pain; determine whether hip is fractured.
- Administer pain medication (determine that there is no associated head injury first).
- Avoid oral medications because patient may need surgery.
- Monitor patient's response to pain management.
- Insert a urinary catheter and monitor urinary output.

**Be Prepared To**

- Start an IV.
- Obtain laboratory work, x-rays, possible computed tomography, or magnetic resonance imaging.
- Assist with setup and application of traction.
- Prepare patient for surgery.

**Possible Causes**

- Osteoporosis, trauma.

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**Pathological Fracture**

**The Patient May Have . . .**

- Sudden pain in leg/hip/back/shoulder/arm while moving in bed, transferring to wheelchair or stretcher, or ambulating. Audible crack may be heard.
- Abnormal or limited motion of extremity.
- Back pain (with spinal compression fracture).
- Unexplained ecchymosis, edema over bone or joint.
- Obvious deformity of extremity.

**Immediate Interventions**

- Immobilize extremity in its position. Do not attempt to realign bone.
- Notify provider.
- Document patient’s status, phone call to provider, and provider response.

**Focused Assessment**

- Assess VS.
- Assess extremity for swelling or hematoma.
Assess sensation and mobility of fingers or toes distal to injury if extremity fracture is suspected.
Assess mobility and sensation of arms and legs if spinal fracture suspected.
Assess history of falls or fractures.

**Stabilizing and Monitoring**

- *Determine extent of injury; provide pain relief.*
- Medicate for pain as indicated. Monitor for signs of respiratory depression or excessive sedation.
- Assist with diagnostic procedures (x-ray or bone scan).
- Prepare patient for surgery, if applicable.
- Assist with casting or immobilization with splint or traction.
- Monitor foot or hand of affected extremity for peripheral neurovascular dysfunction.
- Initiate rehabilitation consultation.
- Initiate care to prevent complications of restricted mobility, such as foot and ankle exercises to decrease risk of deep venous thrombosis, early mobilization, and cough and deep-breathing exercises.

**Be Prepared To**

- Initiate pressure ulcer prevention strategies.
- Manage pain so that patient is comfortable but not sedated.
- Protect patient from additional injury.
- Obtain assistive devices for ambulation or self-care activities.
- Initiate discharge planning and collaborate with home care nurse for follow-up care and prevention.

**Possible Causes**

- Osteoporosis, osteomalacia, primary bone tumors, metastatic bone lesions, Paget’s disease.

---

**Patient Fall**

**The Patient May Have . . .**

- Unexplained abrasions, been found on the floor, or reported falling.

**Immediate Interventions**

- *Do not move patient if he or she is unconscious, complains of severe pain, or has a deformity of an extremity (obvious fracture, internal rotation of hip or knee).*
- *If unconscious, get help, assess ABC, immobilize cervical spine (with light traction, hold head and neck in neutral alignment with body).*
If conscious, have patient lie still while you call for help.
If the patient is alert with no obvious injuries, assist to bed or chair with help from another staff member.
Notify provider.
Document patient’s status, phone call to provider, and provider response.

**Focused Assessment**
- Assess LOC and orientation.
- Assess VS and pain level.
- Assess ability to move all extremities.
- Assess alignment and symmetry of extremities.
- Assess soft tissue and skin for abrasions, swelling, or deformity.
- Assess for acute underlying condition, such as infection, transient ischemic attack, urinary tract infection, hypotension, or cardiac dysrhythmia.
- Assess for orthostasis, problems with gait, changes in mental status, and recent changes in functional status.
- Review records for preexisting conditions, medication use, and previous falls.
- Assess medication administration record for polypharmacy or medication that may have contributed to fall.
- Ask if patient felt dizzy or light-headed before falling.
- Assess environment for potential cause of fall and safety hazards.

**Stabilizing and Monitoring**
* Determine extent of injury; initiate fall prevention strategies.
- Treat minor injuries—clean and dress abrasions; apply ice to contusions or areas of swelling.
- Assess for injuries.
- Monitor patient closely for changes in condition, especially changes in mental status, which can suggest brain injury.
- Assess distal circulation, sensory, and motor function of injured extremities.
- Assess history of falls.

**Be Prepared To**
- Assist with x-rays or other diagnostic tests.
- Modify environment to eliminate hazards.
- Arrange for one-on-one care if patient is confused.
- Administer oxygen.
- Order laboratory tests.
- Complete an incident report.
**Possible Causes**
- Sedation, debilitation, unfamiliar surroundings, side rails left down, call-bell malfunction or not left within easy reach, drug reaction, improper use of restraints, dysrhythmias, altered LOC, altered proprioception, spill on the floor.

### Fall Risk Factor and Nursing Interventions

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Nursing Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polypharmacy</td>
<td>Review medications with provider. Eliminate medications or reduce dosages if possible. Limit number of as-needed medications. Assess drug interactions for additive central nervous system effects.</td>
</tr>
<tr>
<td>Specific medications: benzodiazepines, antipsychotics, hypnotics, sedatives, antidepressants</td>
<td>Avoid medications known to cause adverse events in older patients.</td>
</tr>
<tr>
<td>Deconditioning</td>
<td>Start physical therapy for strengthening exercises, balance training.</td>
</tr>
<tr>
<td>Postural hypotension; change in proprioception</td>
<td>Tell patient to get out of bed or up from a chair slowly; avoid turning on heels quickly. Refer to physical therapy.</td>
</tr>
<tr>
<td>Uneven surfaces, poor lighting</td>
<td>Tell patient to evaluate the walking surface and to be aware of where surfaces change—for example at thresholds in doorways. Make sure home is well lit and objects the patient can use for support (cane, walker) are within reach.</td>
</tr>
</tbody>
</table>
Pressure Ulcer

The Patient May Have . . .
- Reddened, blistered, open skin over pressure point such as sacrum, coccyx, scapula, trochanter, or heel.
- History of immobility, decreased sensorium, incontinence.

Immediate Interventions
- Relieve the pressure by turning patient or supporting extremity with pillows.
  - Do NOT massage the area; massage can cause tissue damage under the skin.
  - Do NOT use doughnut-shaped or ring-shaped cushions or heel booties; these items impede circulation.
- Assess wound using Wound Assessment and Documentation Guide and/or Pressure Ulcer Stages and Treatment chart in this tab.
- Assess patient for other areas of pressure and skin breakdown.
- Notify physician, PA, or NP.
- Document patient status, characteristics of wound, phone call to provider, and provider response.

Focused Assessment
- Assess temperature, VS.
- Assess wound (size, depth, edges, undermining, type and amount of necrotic tissue [color, consistency adherence, and amount], exudate type and amount, color of skin surrounding wound, peripheral tissue edema, induration, granulation tissue, infection). See Wound Assessment and Documentation Guide in this tab.
- Assess patient’s pain level.
- Assess for pressure ulcer risk using validated assessment tool.

Stabilizing and Monitoring
- Initiate appropriate wound care; prevent additional pressure ulcers.
- Perform dressing changes as ordered. (See Wound Care Products in this tab.)
- Turn and reposition patient at least every 2 hr.
- Keep wound free of contamination from urine and stool.
- Assess nutritional status; consult dietitian.

Be Prepared To
- Clean, dress, pack the wound.
- Obtain special wound care products.
- Obtain specialized support surface for bed or wheelchair.

Possible Causes
- Pressure or shearing forces, immobility.
Pressure Ulcer Prevention Strategies

- Use your facility’s risk assessment tool on all patients with limited mobility or impaired level of consciousness.
- Inspect skin daily; document findings.
  
  **Tip** Effectively manage urinary and fecal incontinence. Clean skin promptly, using a mild, nonirritating, nondrying cleansing solution. Avoid friction during cleansing.
- Use topical moisture barriers and moisture absorbing pad for incontinent patients.
- Position patient to alleviate pressure and shearing forces.
- Reposition patient every 2 hr when in bed and every 1 hr when in a chair.
- Teach patient to shift weight every 15 min while in a chair.
- Use positioning devices and foam padding. Do not use doughnut-shaped devices.
- Avoid placing patient on trochanters or directly on a wound.
- Maintain the lowest head elevation possible to prevent sacral pressure.
- Use lifting devices such as draw sheets or a trapeze.
- Prevent contractures.
- Provide adequate nutrition and hydration.
- Do not massage reddened areas over bony prominences.

Unavoidable Pressure Ulcers

It is now recognized that despite appropriate assessment and intervention, the development of pressure ulcers in some instances is unavoidable. Factors that make prevention of pressure ulcers difficult include:

- Hypoalbuminemia (Alb <3.0).
- Respiratory failure with intubation, hypoxemia.
- Severe anemia (hemoglobin <10).
- Sedation.
- Hypotension.
- Sepsis, malignancy, diabetes, renal failure (acute or chronic).

Wound Assessment and Documentation Guide

- Measure length, width, and depth using a centimeter ruler.
- **Assess characteristics of wound edges** (i.e., attached, not attached, fibrotic).
- **Assess for undermining**: Insert a cotton-tipped applicator under the wound edge; gently advance it until resistance is met. Using a felt-tipped pen, mark the skin where applicator is felt. Continue around the wound.
- **Describe necrotic tissue type**.
  - White/gray.
  - Nonadherent yellow slough.
  - Loosely adherent yellow slough.
  - Adherent, soft black eschar.
  - Firmly adherent, hard black.
- **Describe exudate type**.
  - Bloody.
  - Serosanguineous.
  - Serous.
  - Purulent.
  - Foul purulent.
- **Describe exudate amount**.
  - None—wound tissues dry.
  - Scant—wound tissues moist; no measurable exudates.
  - Small—wound tissues wet; drainage involved 25% of dressing.
  - Moderate—wound tissues saturated; drainage involved 25%–75% of dressing.
  - Large—wound tissues bathed in fluid; drainage involves >75% of dressing.
- **Assess and describe skin color surrounding wound**: Assess tissues within 4 cm of wound edge. For light-skinned persons, note if skin is reddened. For dark-skinned persons, note if skin is reddened or darker or purplish around wound edges.
- **Assess wound edge for tissue edema**: Note if edema is pitting or nonpitting and if wound is crepitant (crackly noises when tissue is palpated). *QI RI Notify physician immediately if wound is crepitant: may indicate gas gangrene.*
- **Assess amount of induration**: Induration is abnormal firmness of tissues with margins. Assess by gently pinching the tissue distal to wound edge; if indurated, you will be unable to pinch a fold of skin.

- **Assess for granulation tissue**: Granulation tissue is present in the healing wound. It is the regrowth of small blood vessels and connective tissue. Healthy granulation tissue is bright, beefy red, shiny, and granular. Poorly vascularized tissue supply appears pale pink, dull, or dusky red.

- **Stage the pressure ulcer** (see the following table):
## Pressure Ulcer Stages and Treatment

<table>
<thead>
<tr>
<th>Stage</th>
<th>Ulcer Characteristics</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intact skin. No bluish or discoloration.</td>
<td>No dressing. Prevent continuous injury from pressure.</td>
</tr>
<tr>
<td>II</td>
<td>Eschar and necrosis. Full-thickness skin loss involving damage to deep tissue. Débridement may be done surgically or mechanically with enzymes or wet-to-dry dressings. May extend down to fascia.</td>
<td>Use a dressing that will keep ulcer bed continuously moist. Keep surrounding intact skin dry.</td>
</tr>
<tr>
<td>III</td>
<td>Eschar and necrosis. Full-thickness skin loss involving damage to deep tissue. May extend down to fascia.</td>
<td>Débridement. Uses a dressing that will keep ulcer bed continuously moist. Keep surrounding intact skin dry.</td>
</tr>
</tbody>
</table>

### Interventions

- **Warmth**: Use warm blankets, heating pads, or warm-water bottles. Adjust warmth based on patient's tolerance. Avoid overheating, which can cause burns.
- **Moisture**: Maintain proper moisture levels around the wound to prevent dryness and reduce risk of infection.
- **Dressings**: Use sterile, non-adhesive dressings to keep the wound clean and protected. Change dressings at least twice daily.
- **Nutrition**: Ensure adequate nutrition to support wound healing. Consider supplemental feeding if necessary.
- **Hygiene**: Keep the surrounding skin clean and dry to prevent infection and irritation.
- **Positioning**: Rotate the patient frequently to prevent pressure areas.
- **Education**: Educate the patient and caregivers about pressure ulcer prevention.

---

### Pressure Ulcer Stages

- **Stage I**: Intact skin. No bluish or discoloration. May be painful. Risk for further damage.
- **Stage II**: Eschar and necrosis. Full-thickness skin loss involving damage to deep tissue. May extend down to fascia. Heel, ischial, or coccyx. May extend to subcutaneous tissue. Distinct wound bed with granulation tissue."
<table>
<thead>
<tr>
<th>Stage</th>
<th>Ulcer Characteristics</th>
<th>Interventions*</th>
</tr>
</thead>
</table>
| IV    | Extensive tissue damage. Full-thickness skin loss. Slough or eschar may be present. Extensive destruction and necrosis or damage to muscle, bone, or supporting structures. Undermining and sinus tracts present. | Use clean, dry dressings for 8–24 hr after débridement to control bleeding, then resume moist dressings. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. Must be débrided to expose the wound base so that depth and stage can be determined. Once determined, follow interventions for correct stage. |}

<table>
<thead>
<tr>
<th>Stage</th>
<th>Ulcer Characteristics</th>
<th>Interventions*</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Unstageable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deep tissue injury (DTI)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purple or maroon area of discoloration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blood-filled blister</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moisture barrier or skin sealant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Observe daily.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consider adding a protective dressing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Observe daily.</td>
<td></td>
</tr>
</tbody>
</table>

*Treatment always includes removing source of pressure, shear, or friction; careful observation; cleansing the pressure ulcer appropriately; providing nutritional support as needed; and changing interventions/dressings based on changes in the wound.
Transparency allows visual inspection of wound. Can be a secondary dressing, soothing effect easy to apply. Reduce pain and promote healing.

**Characteristics**

<table>
<thead>
<tr>
<th>Product</th>
<th>Nursing Considerations</th>
<th>Indications</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent Films</td>
<td>Change once daily.</td>
<td>Stage I, II, III, and IV wounds.</td>
<td>Stuffy wounds.</td>
</tr>
<tr>
<td>Hydrogels</td>
<td>Can be a secondary dressing, inspection of wound.</td>
<td></td>
<td>Wound, Stage I and II</td>
</tr>
</tbody>
</table>

**Waterproof**

Do not absorb large amounts of exudate due to large water content. Change once daily.

**Beidermore**

Requires secondary dressing. Do not absorb large amounts of exudate due to large water content. Change once daily.

**Hydrogel**

Provides moist wound environment and prevent bacterial contamination. Provides moist healing wound environment and prevent bacterial contamination.

**Oxycel**

Water vapor permeable to oxygen and wounds, blisters, superficial wounds, blisters. Work best on wounds. Provide moist healing wound environment and prevent bacterial contamination.

**Nurture**

Provide moist healing wound environment and prevent bacterial contamination. Provide moist healing wound environment and prevent bacterial contamination.
Conformable for easy application; help reduce pain at wound site.

Breakdown of product may produce residue and foul odor; do not confuse withinfectious process.

Changed up to three times/week.

Highly absorbent, therefore good for packing exuding wounds.

Require secondary dressing. Therefore highly absorbent. Therefore usually changed once daily.

Highly absorbent, therefore good for packing exuding wounds.

Stage II and III wounds.

Granulating and epithelializing wounds.

Stage II and III wounds.

Soft nonwoven fibers derived from seaweed.

Can absorb up to 20 times their weight.

Can absorb up to 20 times their weight.

Alginates

AlgiDERM

Sorbsan

Algosteril

Occlusive and adhesive wafer dressings or hydrocolloid powders and pastes.

Facilitate rehydration and autolytic débridement of dry, sloughy, or necrotic wounds.

Require secondary dressing. Usually changed once daily.

Stage III and IV wounds with moderate to heavy exudate, but not wounds with eschar or dry wound beds.

Stage II and III wounds.

Granulating and epithelializing wounds.

Epithelialization and occlusion of dressings

Wound Care Products—cont'd

<table>
<thead>
<tr>
<th>Product</th>
<th>Characteristics</th>
<th>Indications</th>
<th>Nursing Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocolloid dressings</td>
<td>Can absorb up to 20 times their weight.</td>
<td>Granulating and epithelializing wounds.</td>
<td>Usually changed once daily.</td>
</tr>
<tr>
<td>Tegasorb</td>
<td></td>
<td>Necrotic wounds.</td>
<td></td>
</tr>
<tr>
<td>Comfeel</td>
<td></td>
<td>Acetolytic débridement.</td>
<td></td>
</tr>
<tr>
<td>DuoDERM Restore</td>
<td></td>
<td>Epithelialization and occlusion of dressings.</td>
<td></td>
</tr>
<tr>
<td>Alginates</td>
<td></td>
<td>Wound care of dry, sloughy, or necrotic wounds.</td>
<td></td>
</tr>
<tr>
<td>CURASORB</td>
<td></td>
<td>Occlusive and adhesive.</td>
<td></td>
</tr>
<tr>
<td>SURFASORB</td>
<td></td>
<td>Granulating and epithelializing.</td>
<td></td>
</tr>
<tr>
<td>Sorbsan</td>
<td></td>
<td>Soft nonwoven fibers.</td>
<td></td>
</tr>
<tr>
<td>Algosteril</td>
<td></td>
<td>Available in pads, ropes.</td>
<td></td>
</tr>
<tr>
<td>AlgiDERM</td>
<td></td>
<td>Available in pads, ropes.</td>
<td></td>
</tr>
</tbody>
</table>
### Wound Care Products—cont'd

<table>
<thead>
<tr>
<th>Product</th>
<th>Characteristics</th>
<th>Indications</th>
<th>Nursing Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foam dressings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexzan</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Curafoam</td>
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<td></td>
</tr>
<tr>
<td>Mepilex</td>
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<td></td>
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</tr>
<tr>
<td><strong>Enzymatic agents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panafil</td>
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<td></td>
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<tr>
<td>Santyl</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuzyme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hydrophilic foam</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexzan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mepilex</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Product**
- **Characteristics**
- **Indications**
- **Nursing Considerations**

**Note:**
- Hydrophilic foam dressings made from highly absorbent foam.
- Some have adhesive borders.
- Enzymatic agents selective in removing necrotic tissue.
- May remove debris, promote autolytic debridement.
- Stage III and IV wounds.
- Tunnelling wounds (may remove debris).
- High risk wounds, especially during inflammatory phase following debridement.
- May be left undisturbed for 3–4 days. Decreases maceration of surrounding tissue.
- Comfortable and conformable.
- Surgical debridement may be avoided in some cases.
- Can be left undisturbed for 3–4 days.
- Allow less frequent dressing changes.
- Highly absorbent foam may be required.
- Use of enzymatic debridement avoided in some cases.
- Enables 3–4 days of undisturbed care.
- Some have adhesive borders.
- May remove debris, promote autolytic debridement.
- Highly absorbent foam dressing may be required.
- Stage III and IV wounds.

**Wound Care Products—cont'd**

- **Highly absorbent foam** may allow less frequent dressing changes.
- Requires prescription.
- Agents selective in removing necrotic tissue from wound bed.
- Surgical debridement may be avoided in some cases with use of enzymatic debridement agents.
- Stage III and IV wounds with heavy exudate, especially during inflammatory phase following debridement.
- Deep cavity wounds and weeping ulcers with heavy exudate.
- Tunnelling wounds (may remove debris in hidden areas).
- Stage III and IV wounds.
- Requires prescription.
- High risk wounds, especially during inflammatory phase following debridement.
- May be left undisturbed for 3–4 days.
- Allow less frequent dressing changes.
- Highly absorbent foam may be required.
- Use of enzymatic debridement avoided in some cases.
- Enables 3–4 days of undisturbed care.
<table>
<thead>
<tr>
<th><strong>Wound Care Products—cont'd</strong></th>
<th><strong>Characteristics</strong></th>
<th><strong>Indications</strong></th>
<th><strong>Nursing Considerations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimicrobial dressings impregnated with silver or cadexomer</td>
<td>Available in gels or pastes, provides immediate and controlled release of silver, inhibits bacterial growth</td>
<td>Infected and/or heavily colonized wounds.</td>
<td>Infected wounds.</td>
</tr>
</tbody>
</table>

| Honey-impregnated dressings | Available in a gel, paste, or spray. | Nonhealing stage III wounds. | Honey-impregnated dressing | Provides a structure for new collagen and granulation tissue. Absorbent and conforms to wound. | Honey-impregnated dressing | 

| Collagen matrix dressings | Prisma Promograft, BioPad Fibracol Plus | Stage II and III wounds. | Collagen | Provides a structure for new collagen and granulation tissue. Absorbent and conforms to wound. | Collagen matrix dressings | 

| Other biological dressings include tissue-engineered cultured skin products and growth factors. | | | | | |
Wound Vacuums

Vacuum-assisted closure (VAC) units are negative-pressure devices that help promote wound healing by removing exudate with continuous or intermittent suction. The suction also helps pull the wound edges together, stimulates granulation tissue, and improves blood flow to the wound bed.

Setting Up the Wound VAC

- Wash your hands, don gloves, and clean the wound using aseptic technique.
- Apply skin preparation to periwound area to help secure the dressing.
- Cut foam to fit wound, and place in the wound; do not push it in, just place it on the wound.
- Apply Tegaderm-like plastic sheet over foam and onto healthy skin; put it on in patches, if necessary.
- Cut a small hole in the plastic sheet over the foam. This is essential for suction to reach wound bed.
- Apply suction disk over the hole in the plastic dressing.
- Connect suction tubing, remove kinks, and set suction as ordered.
- Discard old dressing properly, remove gloves, wash hands.

Surgical Site Infection/Complication

The Patient May Have . . .

- Warm, reddened, tender, swollen, painful wound.
- Low-grade fever.
- Separation of wound edges with serous-sanguineous or purulent drainage from wound.
- Purulent discharge from wound drain.
- Feeling of wound tearing or opening.
- Exposure or protrusion of abdominal contents through open wound.

Immediate Interventions

- Examine wound for evisceration—total separation of deep wound layers (fascia and muscle) with protrusion of internal organs and viscera; dehiscence—partial or complete separation of deep wound layers; or superficial wound separation—separation of skin and subcutaneous tissue.
Abdominal wound: If there is evidence of dehiscence or evisceration, place the patient in semi-Fowler’s position, with knees bent to decrease tension on abdominal wall. Saturate a sterile dressing with normal saline, and cover the open wound. Place a large sterile dressing over top. Do not manipulate viscera or attempt to replace. Keep patient NPO (nothing by mouth) and NOTIFY PROVIDER.

- Stay with patient and offer support and reassurance.
- For dehiscence of wounds elsewhere on the body, position patient to alleviate tension on suture line, then saturate a sterile dressing with normal saline, and cover the open wound. Place a large sterile dressing over top. Notify provider immediately.
- For superficial wound separation, cover wound with a sterile normal saline wet-to-dry dressing. Notify provider.
- If evidence of infection, obtain wound culture.
- Assess for patent IV access.
- Assess pain level, and medicate per order.
- Document patient’s status, phone call to provider, and provider response.

**Focused Assessment**

- Assess temperature and other VS.
- Assess wound: determine or describe size, depth, edges, undermining, type and amount of necrotic tissue (color, consistency adherence, and amount), exudate type and amount, color of skin surrounding wound, peripheral tissue edema, induration, granulation tissue, infection. (See Wound Assessment and Documentation Guide in this tab.)
- Assess patient’s pain level.

**Stabilizing and Monitoring**

- Prevent or treat infection; prevent complications; initiate appropriate wound care.
- Perform dressing changes as ordered.
- Administer antibiotics.
- Assess nutritional status; consult dietitian.

**Be Prepared To**

- Prepare the patient for surgery.
- Clean, dress, pack the wound.
- Start an IV.

**Possible Causes**

- Infection, excessive tension on suture line (vomiting or coughing), dehydration, long surgery time, hematoma, abdominal distention, obesity, poor nutritional status, diabetes, insufficient suturing, stretching or pulling at suture site (trauma), higher risk in geriatric patients.
Skeletal system.
INFECT

Rapid Infection Assessment

■ Infection is the presence and growth of pathogenic microorganisms in body tissues that results in tissue damage. Infections can be caused by bacteria, viruses, protozoa, parasites, or fungi.

■ Colonization is the presence and growth of microorganisms on the skin, in the nares, or in other areas that do not cause tissue damage. The patient does not show signs of infection but is considered a carrier.

■ Infectious diseases, also called communicable diseases, are illnesses caused by pathogens that can be transmitted from person to person.

■ Bacteremia is the presence of bacteria in the blood. It can result in widespread infection of organs and tissues, which is called sepsis.

■ Infections can be primary, in which a pathogen causes infection in otherwise healthy individuals because of its natural virulence, or opportunistic, in which a pathogen with low virulence causes an infection in individuals because they are immunocompromised.

■ Some infections are highly contagious, meaning that they are easily transmitted from person to person. Patients with highly contagious infections are placed in isolation. Other infections do not require isolation because the method of transmission is very specialized.

■ The four main types of infectious pathogens are bacteria, viruses, fungi, and protozoa.

■ Bacteria are categorized by shape:
  ■ Spherical bacteria are called cocci.
  ■ Rod shaped bacteria are called bacilli.
  ■ Spiral shaped bacteria are called spirilla.
  ■ Curved rods are called vibrio.

■ Infections caused by bacteria are often localized and can be treated with antibiotics.

■ Viruses cause systemic infection; antivirals can slow viral reproduction but cannot stop it.

■ Fungal infections of the skin and mucus membranes, such as athlete’s foot or oral thrush, are generally not serious.

■ Internal fungal infections such as in the lungs or brain, are very serious and often fatal.

■ Protozoa cause parasitic infections in humans such as malaria and sleeping sickness.
Assessing a patient for an occult (source not obvious) infection involves:

- Taking a careful history.
- Assessing vital signs (VS). Changes associated with infection include fever, tachycardia, tachypnea, and hypotension.
- Checking for current or recent invasive lines, apparatus, or instrumentation (e.g., urinary catheters, chest tubes, incisional drains, central lines, or colonoscopy).
- Checking recent hematology results for abnormal white blood cell count.
- Performing a review of systems or head-to-toe assessment.
- Assessing for headache, neck stiffness, change in mental status, restlessness.
- Auscultating lungs for adventitious sounds or areas where breath sounds are diminished.
- Assessing pulse oximetry for hypoxemia.
- Assessing for enlarged liver, spleen, or lymph nodes.
- Assessing the abdomen for distention, tenderness, presence or absence of bowel sounds.
- Assessing for diarrhea if stool is bloody or contains pus and if patient has recently been on antibiotics, especially cephalosporins or clindamycin.
- Assessing urine for cloudiness or foul smell.
- Assessing for suprapubic or costovertebral angle (CVA) tenderness.
- Asking patient about urgency or burning with urination.
- Assessing both lower extremities for warmth, redness, or swelling (do not massage calves; just touch gently to assess skin temperature).
- Assessing skin for rash; pressure ulcers; break in integrity; dry or cracked mucous membranes; areas of redness, swelling, or warmth.
- Assessing surgical incisions for pain, warmth, redness, discharge, or crepitance.
- Assessing intravenous (IV) lines for redness, induration, warmth.
- Obtaining cultures of blood, urine, and sputum.
- Assisting with or facilitating transport for diagnostic testing such as x-rays, magnetic resonance imaging (MRI), or computed tomography (CT) scan.
Nosocomial or Hospital-Acquired Infections

- Nosocomial or **hospital-acquired infections** (HAI) refer to infections that develop while the patient is hospitalized or up to 30 days after discharge.
- The most common nosocomial infections are:
  - Central line-associated bloodstream infections (CLABSI).
  - Catheter-associated urinary tract infections (CAUTI).
  - Surgical-site infection (SSI).
  - Ventilator-associated pneumonia (VAP).
  - *Clostridium difficile* gastroenteritis.
  - Vancomycin-resistant enterococcus (VRE).
- Risk factors include:
  - Health status of patient (immunocompromised, underlying diseases, age, etc.).
  - Presence of invasive lines and devices.
  - Treatments that increase infection risk.
  - Immunocompromised from medications or illness.
  - Mechanical ventilation.
- Nosocomial infections are especially dangerous because the pathogens are often resistant to antibiotics.
- Elderly and immunocompromised patients may not develop a fever in response to infection; in fact, they may be hypothermic. Often in these patients, the first sign of infection is tachypnea or confusion.

**Clostridium-Associated Diarrhea (CDAD; Pseudomembranous Colitis)**

A potentially fatal, usually hospital-acquired, infection of the colon. *C. difficile* produces a number of toxins that cause inflammation and diarrhea. New strains are emerging that produce more toxins, are resistant to fluoroquinolones, demonstrate increased virulence, and occur in people who have not been hospitalized or used antibiotics. Transmitted by fecal-oral route. Alcohol-based hand sanitizers are ineffective in eliminating *C. difficile* spores; soap and water or bleach wipes are effective. Two patients with CDAD can share a room; if that is not possible, the patient with CDAD must be in a single room.
The Patient May Have . . .

- Watery diarrhea, possibly with blood, three or more times per day (up to 10–15 times per day with severe infection). Diarrhea has a distinctive foul odor, described as being similar to horse manure.
- Abdominal cramping, pain, and tenderness.
- Fever up to 105°F.
- Loss of appetite, nausea.
- Recent history of treatment with broad-spectrum, multiple antibiotics, or chemotherapy.

Immediate Interventions

- Assess hydration status, electrolyte balance.
- Note trends in VS; reassess as needed.
- Assess for recent antibiotic use; if patient is still on antibiotics, withhold until you speak with the provider. *C. difficile* infection is usually caused by antibiotic-induced derangement of normal intestinal flora, and discontinuation of the antibiotic, if feasible, is part of the treatment.
- Call physician, physician’s assistant (PA), or nurse practitioner (NP) about the character and frequency of the stool and other findings.
- Document findings, phone call to provider, and provider’s response.
- Move patient to a private room and initiate contact precautions.
- Obtain stool sample for laboratory testing.

Focused Assessment

- Assess for IV access, as rehydration may be necessary.
- Assess stool for blood or pus, which can occur with severe infection.
- Auscultate bowel sounds, and palpate abdomen for tenderness.
- Assess urine output, blood urea nitrogen (BUN), and creatinine to detect early onset of kidney failure.

Stabilizing and Monitoring

- Treat *C. difficile* infection; prevent or manage complications; reduce potential for recurrence; prevent transmission to other patients.
- Make sure all visitors wear gloves when touching the patient and wash their hands with soap and water each time before they leave the room.
- Administer oral metronidazole or vancomycin as ordered.
- Collect stools for testing as ordered.
- Provide incontinence care if needed, and monitor perianal skin for breakdown.
Monitor hydration status and food intake.
Monitor electrolytes, albumin, white blood cell (WBC) count.
Assess for complications of severe infection including anasarca, dehydration.

**RI** Assess for signs of toxic megacolon; look for new onset of distention, pain, increased frequency or sudden cessation of bowel movements, tachycardia, and hypotension or colonic perforation.

**RI** Assess for signs of colonic perforation (severe abdominal pain, chills, fever, nausea, and vomiting) and peritonitis (exhaustion, decreased urine output, tachycardia, shortness of breath [SOB]).

**Be Prepared To**
- Transfer patient to high-acuity unit if infection is severe with complications.
- Insert an IV and hang IV fluids, begin medications promptly.
- Obtain chest and abdominal x-rays or CT scan.
- Obtain WBC count.

**Possible Causes**
- *C. difficile*, which produces toxins that cause tissue damage; inflammation of colonic tissues.

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**Fever of Unknown Origin (FUO)**

The potential causes of FUO are categorized as classic, nosocomial, immune deficient, and HIV related. These groups assist in narrowing the field of possible diagnoses (see table).

**The Patient May Have . . .**
- Fever >101°F, either continuous or intermittent, for at least 3 weeks.
- Chills.
- Night sweats.
- Change in mental status.
- Fatigue, weakness.
- Flushed, dry skin.
- Weight loss.

**Immediate Interventions**
- Assess VS.
- Offer cool compress for forehead.
Focused Assessment

- Ask about travel history, immunization status, sexual history, recent exposure to insects or animals.
- Ask about recent abdominal surgery, trauma, inflammatory bowel disease, or gynecological procedures to determine likelihood of an intra-abdominal abscess.
- Auscultate lungs for diminished breath sounds, crackles, rhonchi.
- Assess for stiff neck, headache, photophobia, irritability, confusion.
- Assess IV sites, surgical incisions for redness, warmth, tenderness, and swelling.
- Assess legs for swelling, warmth, pain (do not massage calves).
- Auscultate heart sounds to assess for murmurs.
- Assess groin, neck, and axilla for enlarged lymph nodes.
- Assess for flank pain, urinary symptoms.
- Assess for gastrointestinal (GI) symptoms.
- Evaluate medications for possible drug fever or immunosuppression; note any rashes.
- Assess mucous membranes, intake and output (I&O).
- Determine if the patient has any prosthetic implants (heart valve, artificial joint).
- Check labs for increased WBC count.
- Document patient’s status.

Stabilizing and Monitoring

- **Determine source of infection; initiate treatment promptly.**
- Encourage fluids (unless contraindicated by renal or cardiac disease).
- Check medication administration record for order for PRN antipyretic. Administer if patient feels uncomfortable.
- Obtain cooling blanket or give tepid bath if ordered.
- Assess temperature every 4 hours.

Be Prepared To

- Obtain sputum, blood, or urine sample for Gram stain, culture, and sensitivity.
- Obtain or change IV access.
- Order a chest x-ray, CT of abdomen and pelvis, MRI, Doppler, echocardiogram.
- Order or obtain laboratory tests including CBC with differential, basic chemistries, erythrocyte sedimentation rate (ESR), antinuclear antibody (ANA), rheumatoid factor (RF).
Possible Causes

Numerous potential causes include bacterial, viral, or fungal infection; deep venous thrombosis (DVT); medications; tumor; neutropenia.

<table>
<thead>
<tr>
<th>FUO Category</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classic</td>
<td>Infections, malignancies, collagen vascular diseases, miscellaneous diseases</td>
</tr>
<tr>
<td>Nosocomial</td>
<td><em>C. difficile</em> enterocolitis, medication-related, pulmonary embolism, septic thrombophlebitis, sinusitis (for patients with nasogastric or nasotracheal tube)</td>
</tr>
<tr>
<td>Immune deficient (neutropenic)</td>
<td>Opportunistic bacterial infection, aspergillosis, candidiasis, herpes virus</td>
</tr>
<tr>
<td>HIV-associated</td>
<td>Cytomegalovirus, <em>Mycobacterium avium</em>-intracellulare complex, medication induced, Kaposi's sarcoma, lymphoma</td>
</tr>
</tbody>
</table>

Fever with Systemic Inflammatory Response Syndrome/Sepsis

Terms:
- **Infection**: Inflammatory response to microorganisms, or the invasion of normally sterile host tissue by those organisms.
- **Systemic inflammatory response syndrome (SIRS)**: Systemic inflammatory response to severe clinical insults, including infection, pancreatitis, trauma, and burns. This response is manifested by two or more of the following conditions:
  - Core temperature >100.4°F or <96.8°F.
  - Heart rate (HR) >90 beats/min.
  - Respiratory rate (RR) >20 breaths/min or partial pressure of CO₂ <32 mm Hg.
  - WBC count >12,000/mm³, <4,000/mm³, or the presence of >10% immature neutrophils.
  - Acute change in mental status.
  - Hyperglycemia (>140 mg/dL) in nondiabetic patient.
- **Sepsis**: A systemic inflammatory response to infection that initiates a cascade of biochemical events resulting in hypotension, coagulopathy, suppression of fibrinolysis, and multisystem organ dysfunction.
Sepsis is diagnosed when there is a documented infection with at least two systemic inflammatory response criteria.

- **Severe sepsis**: Sepsis with dysfunction of one or more organ systems, hypoperfusion, or hypotension as evidenced by
  - BP <90/60 mm Hg or mean arterial pressure (MAP) <65 mm Hg.
  - Mottled skin, capillary refill ≥3 sec.
  - Acute renal failure or urine output <0.5 mL/kg/hr for at least 2 hr.
  - Creatinine >2.0 mg/dL.
  - Elevated lactate levels.
  - Platelets <100,000 µL.
  - International normalize ratio (INR) >1.5.

- **Septic shock**: Sepsis with hypotension (systolic BP <90 mm Hg or a reduction of 40 mm Hg from baseline) *despite adequate fluid resuscitation* and with perfusion abnormalities that include lactic acidosis, oliguria, or change in mental status (see above).

- **Multiple organ dysfunction syndrome**: Altered organ function in an acutely ill patient such that homeostasis cannot be maintained without intervention.

**The Patient May Have . . .**

- Temperature >100.4°F or <96.8°F.
- Chills, sweating.
- Tachypnea, respiratory alkalosis.
- Tachycardia.
- Elevated or depressed WBC count.
- Change in mental status.
- Abdominal or flank pain.
- Rash; warm, dry, flushed skin.

**Progressive Indications:**

- Restlessness, confusion, altered level of consciousness (LOC).
- Hypotension, widening pulse pressure.
- Oliguria.
- Rapid thready pulse, delayed capillary refill.
- Decreased urinary output.
- Hypoactive bowel sounds.
- Rapid shallow breathing.
- Cold, clammy, mottled skin.

**Immediate Interventions**

- Assess HR, BP, RR, and temperature (rectally).
- Administer supplemental oxygen.
Assess for patent IV access.
Obtain oxygen saturation (Sao₂) via pulse oximetry.
Review recent WBC count if available.
**RI** Notify physician, PA, or NP; SIRS and sepsis are life threatening.
Insert two large-bore IV lines (with order).
Obtain IV fluids (normal saline) for administration.
Document patient’s status, phone call to provider, and provider response.

**Focused Assessment**
- Screen for signs and symptoms of SIRS and sepsis (see indicators earlier in tab).
- Assess airway status, LOC, and VS frequently.
- Assess Sao₂ via pulse oximetry.
- Assess tissue perfusion.
- Assess onset, recent history of fever.
- Assess for possible source of infection.

**Stabilizing and Monitoring**
- Rapid identification of patients with sepsis/severe sepsis; administration of antibiotics within 1 hour; transfer to appropriate level of care.
- Obtain blood cultures before administration of antibiotics.
- **RI** Administer prescribed broad-spectrum antibiotic STAT.
- **RI** Administer isotonic IV fluids to correct hypovolemia (due to vasodilation and capillary leak) and to restore blood pressure and tissue perfusion.
- Administer vasopressors as ordered if patient is still hypotensive after receiving adequate IVFs. Carefully monitor hemodynamic status; maintain MAP of 65 mm Hg.
- **RI** Monitor for signs of volume overload: dyspnea, pulmonary crackles, jugular vein distention.
- Monitor mental status, HR, BP, capillary refill, and urine output.
- Monitor coagulation studies, BUN, and creatinine.
- Monitor glucose levels, even in nondiabetic patients.
- **SI** Administer low-dose heparin to prevent DVT and proton pump inhibitors to prevent gastric stress ulcer as ordered. If not ordered, discuss with physician, PA, or NP.

**Be Prepared To**
- Obtain urine, blood, wound, and sputum samples for culture.
- Assist with central line placement.
Order or obtain laboratory tests.
- Facilitate diagnostic testing such as x-rays or CT scan.
- Insert indwelling urinary catheter.
- Administer vasoactive drugs to treat hypotension.
- Assist with intubation and airway management.
- Call a code.
- Transfer patient to intensive care unit (ICU) or monitored unit.

Possible Causes
- Head and neck infections; chest and pulmonary infections; GI infections; pelvic/genitourinary infections; bone, soft tissue, and skin infections.

Hepatitis

Inflammation of liver cells resulting in necrosis and obstruction of bile. There are many forms of hepatitis, including viral, bacterial, alcoholic, and drug-induced hepatitis. The various forms of viral hepatitis are named with a letter of the alphabet, using A through G. Most patients with viral hepatitis do not require hospitalization unless the patient is vomiting and dehydrated or has signs of acute liver failure or fulminant hepatic failure (FHF), which is acute liver failure complicated by hepatic encephalopathy. Many patients hospitalized for other reasons have chronic hepatitis.

The Patient May Have . . .
- Fever, loss of appetite, nausea, and vomiting.
- Fatigue, headache.
- Tea-colored urine, clay-colored stools, jaundice.
- Right upper quadrant abdominal pain.

Immediate Interventions
- Assess laboratory values for positive hepatitis test.
- Institute contact precautions if needed (see following table).

Focused Assessment
- Assess pain, activity tolerance, appetite.
- Assess for jaundice.
- Observe urine for characteristic tea color and stools for the absence of bile, which renders them clay colored.

Check prothrombin time (PT) and INR for elevations, which are the earliest signs of acute liver failure.
- Observe for signs of encephalopathy—confusion, lethargy, stupor, or coma, which indicates acute liver failure.
Notify physician, PA, or NP of elevated PT or INR, or decreasing LOC.

- Document findings, phone call to provider, if made, and provider’s response.

**Stabilizing and Monitoring**
- Supportive care, early detection of disease progression, treatment with appropriate drugs depending on virus type.
- Continue ongoing assessment.
- Check finger stick glucose if there is a change in mental status.
- Implement energy-conserving routines for self-care.
- Teach patient about self-care during recovery and how to prevent transmission to others.

**Be Prepared To**
- Initiate precautions.
- Obtain laboratory work for markers of hepatitis infection, liver function tests, PT, INR, bilirubin, BUN, creatinine, ammonia levels.

**Possible Causes**
- Viral infection.

### Precautions for Major Types of Viral Hepatitis

<table>
<thead>
<tr>
<th>Type and Route of Transmission</th>
<th>Precautions/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAV Fecal-oral route; exposure to contaminated food or water eating raw shellfish taken from contaminated water, or eating fruits and vegetables contaminated during handling</td>
<td><strong>Standard precautions plus contact precautions.</strong>&lt;br&gt;Most people with HAV get better on their own after a few weeks. Does not progress to chronic hepatitis.&lt;br&gt;Children and adults should be vaccinated against HAV.</td>
</tr>
<tr>
<td>HBV Parenteral: blood-to-blood contact; saliva can contain low concentrations of hepatitis B virus, thus can be spread by a bite</td>
<td><strong>Standard precautions.</strong>&lt;br&gt;Not transmitted by casual contact.&lt;br&gt;Children and adults should be vaccinated against HBV. Can progress to chronic hepatitis.</td>
</tr>
</tbody>
</table>

*Continued*
Meningitis

Inflammation of the meninges, which cover the brain and spinal cord. May be septic meningitis, which is caused by bacteria, or aseptic, which is viral or secondary to a lymphoma, leukemia, or a brain abscess. Bacterial meningitis is contagious and is much more severe than viral meningitis; it will be fatal if not treated promptly. Viral meningitis is often mild and self-limited. Antiretroviral therapy may be needed for HIV meningitis. Other medications target the underlying organism, for example, antifungals.

The Patient May Have . . .

- Fever, headache, neck stiffness, nausea, and vomiting.
- Lethargy, confusion, delirium, seizure.
- Petechial rash.
- Photophobia, sore throat, weakness.

<table>
<thead>
<tr>
<th>Type and Route of Transmission</th>
<th>Precautions/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCV Parenteral: blood-to-blood contact; can be sexually transmitted</td>
<td><strong>Standard precautions.</strong> Not spread by casual contact or through food or water. HCV is the most common cause of liver disease, liver transplant, and liver cancer.</td>
</tr>
<tr>
<td>HDV Parenteral: blood-to-blood contact</td>
<td><strong>Standard precautions.</strong> Patients are coinfected with HBV. Can progress to chronic hepatitis.</td>
</tr>
<tr>
<td>HEV Fecal-oral: possible person-to-person contact</td>
<td><strong>Standard precautions plus contact precautions.</strong> Most people with HEV get better on their own after a few weeks. Does not progress to chronic hepatitis.</td>
</tr>
</tbody>
</table>
Immediate Interventions
■ Assess VS, LOC, SaO₂.

■ Check to see if dexamethasone should be administered with antibiotic.
■ Institute droplet precautions for bacterial meningitis; maintain until 48 hr after antibiotics are started.
■ Discuss diagnosis with provider for information about causative organism.
■ Document findings.

Focused Assessment
■ Assess cranial nerves for possible complication (hearing loss, visual impairment, nerve palsy). See Cranial Nerve Assessment in Neurological tab.
■ Assess for Brudzinski’s sign (hip and knee flexion in response to forced flexion of the neck).
■ Assess for Kernig’s sign (inability to completely extend the legs).
■ Assess for systemic complications of bacterial meningitis including hypotension, shock, hypoxia, hyponatremia, cardiac dysrhythmias, stroke, increased intracranial pressure (IICP).

Initiate seizure precautions.

Stabilizing and Monitoring
Prompt initiation of antibiotics, prevention of complications, management of fever and pain.
■ Continued assessment for potential complications.
■ Monitor neurological status.
■ Monitor blood, kidney, and liver studies for signs of drug toxicity.
■ Record I&O, and observe patient for signs of dehydration.
■ Administer IV fluids and medications, as ordered by the physician.
■ Monitor patient’s vital signs and neurological status and record. Use Glasgow Coma Scale in Neurological tab for accuracy and consistency.
■ Provide supportive care.

Be Prepared To
■ Assist with lumbar puncture (LP).
■ Send patient for CT scan or MRI before LP to rule out potential for brain herniation.
■ Obtain blood for CBC, blood cultures, protein.
Possible Causes

- Bacterial, viral, fungal, amoebic, neonatal, or tuberculosis (TB) infection.

MRSA and Vancomycin-Resistant Staph Infection

Methicillin-resistant *Staphylococcus aureus* (MRSA) infection is caused by *S. aureus* bacteria, which are often found in hospitals. *S. aureus* is resistant to the broad-spectrum antibiotics commonly used to treat it. A patient or health care worker can be colonized with MRSA, which means the bacterium lives on the skin and nares but does not cause infection. The danger with colonization is that the patient or health care worker can transmit the bacteria to others, who may develop the hard-to-treat infection. CA-MRSA is community-acquired MRSA; CA-MRSA infections are often skin infections. HA-MRSA is a MRSA infection acquired in the hospital; HA-MRSA infections are often internal and can be fatal. Vancomycin is one of the few antibiotics that effectively treats MRSA; however, vancomycin-resistant staph has begun to emerge.

The Patient May Have . . .

- Small, red, pimple-like bumps that look like boils or spider bites.
- Erythema, swelling, and warmth around bumps; purulent drainage.
- Fever, SOB, chest pain, muscle aches.
- Painful skin abscesses.
- Infection of bone, joints, incisions, blood, cardiac valves, lungs.

Immediate Interventions

- Using gloves, cover the wound(s), abscesses, or bumps with a clean, dry dressing; wash hands thoroughly.
- Assess for signs of cellulitis—extensive redness, warmth, and swelling in tissues adjacent to site of injury; rash, blisters, tenderness; cellulitis can spread quickly.
- Assess VS.
- Notify provider of possible staph infection.
- Document phone call and provider response.

Focused Assessment

- Assess for signs and symptoms of internal infection: auscultate lungs for adventitious sounds; take apical pulse, and listen for murmurs;
assess urine for cloudiness; check BUN and creatinine for signs of renal impairment.

- Ask patient about general aches and pains, chills, headache, feeling sick (malaise).
- Obtain culture of wound and drainage.
- Obtain blood cultures.
- If pneumonia is suspected, obtain sputum culture.
- If urinary tract infection is suspected, obtain urine culture.

**Stabilizing and Monitoring**

- **O1** Prompt initiation of antibiotics; prevention of transmission to other patients or staff.
- Initiate contact precautions (see Contact Precautions in this tab).
- Move patient to private room.
- Wear a mask if patient has a productive cough.
- **O1** Start antibiotics promptly and maintain schedule.
- Do not discontinue contact precautions until two sets of cultures, taken 24 hr apart and 48 hr after all antibiotics are discontinued, are negative for MRSA.

**Be Prepared To**

- Transfer patient to ICU if septic.
- Teach family about preventing spread of MRSA.
- Assist with incision and drainage of skin abscesses.

**Possible Causes**

- *S. aureus* colonization or infection.

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**Necrotizing Fasciitis (NF)**

NF is a rapidly progressing infection caused by *Streptococcus pyogenes*. It affects the deeper layers of skin and tissue and requires immediate intervention because it has a high mortality rate.

**The Patient May Have . . .**

- Minor skin disruption, no disruption at all, or major disruption (e.g., surgical incision).
- Severe or worse than expected pain at site, which gets progressively worse.
- Cellulitis-like appearance of affected area (red, hot, and painful to the touch).
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- Swollen, purplish, blistered tissue with foul-smelling, watery discharge.
- High fever with flulike symptoms.
- Dehydration and hypotension.

**Immediate Interventions**
- Take the patient’s VS.
  - **QI** Circle the affected area on the dressing, if present, or apply a dressing, and circle the area so that rapid spreading can be ascertained.
  - **RI** Call physician, PA, or NP; describe the affected area and patient’s condition.
- Document your findings, phone call to provider, and provider response.

**Focused Assessment**
- Assess and document VS frequently, at least every half hour.
- Assess area for rapid progression of swelling, erythema, and crepitance.
- Assess for changes in skin such as a grayish color beneath the skin, blackened areas (necrotic tissue), purple blisters, foul drainage.
- Assess laboratory values; ↑BUN; ↓sodium, ↑WBCs, are common with NF.

**Stabilizing and Monitoring**
- **QI** *Urgent diagnosis of NF and initiation of treatment.*
- **QI** Obtain wound cultures immediately so that antibiotics (penicillin and clindamycin) can be given.
- **QI** Insert an IV and hang ordered IV fluids.
- **QI** **RI** Administer antibiotics; delay in administration of the correct antibiotics is associated with a higher mortality rate.
- Monitor VS frequently.
- Facilitate assessment of laboratory values.
- Administer pain medication.
- Institute contact isolation or precautions.
- Change dressings as ordered.

**Be Prepared To**
- Assist with bedside débridement, or get the patient ready for the surgery.
- Obtain x-rays or CT.
- Start a heparin drip (to decrease risk of vasculitis and thrombosis).
- Transfer the patient to ICU.
Possible Causes
- Infection with Group A *beta-hemolytic streptococcus* alone or in combination with *S. aureus*; infection with *Clostridium, Peptococcus, Escherichia coli, Pseudomonas, S. pyogenes, S. aureus*, or *S. marcescens*.

PNEUMONIA

Acute infection of the lungs. Alveoli become inflamed and fluid-filled.

**The Patient May Have . . .**
- Cough, chest pain, fever, tachycardia.
- Shortness of breath, cyanosis, tachypnea, hemoptysis.
- Joint pain, muscle aches.
- Loss of appetite, fatigue.

**Immediate Interventions**
- Assess VS, and determine whether patient has SOB.
- Apply O₂ if already ordered.
- Assess HR and RR; note whether patient is short of breath or struggling to breathe.
- Listen to lung sounds, assess use of accessory muscles.
- Notify physician, PA, or NP of assessment findings.
- Document phone call and provider response.

**Focused Assessment**
- Assess sputum quantity and character.
- Assess oxygen saturation by pulse oximetry.
- Assess LOC and orientation.
- Assess for pleuritic chest pain, chills.
- Assess for cyanosis.
- Assess appetite.
- Assess for patent IV line.

**Stabilizing and Monitoring**
- Prompt diagnosis and initiation of antibiotics.

**QI** Administer antibiotics as soon as possible; prompt initiation (within 1 hr) is associated with improved outcomes.
- Maintain O₂, and check oxygen saturation frequently.
- Keep patient well hydrated.
- Provide diet high in protein.
Assess for complications such as empyema, respiratory distress, or superinfection (worsening signs and symptoms despite treatment).

Be Prepared To
- Obtain sputum culture and sensitivity, blood cultures, ABGs, or other laboratory work.
- Assist with thoracentesis, and monitor for complications (pneumothorax).
- Obtain chest x-ray.
- Suction the patient; assist with bronchoscopy.

Possible Causes
- Viral, fungal, bacterial infection; prolonged bedrest; mechanical ventilation; TB; aspiration; smoking; malnutrition; upper respiratory tract disorder.

The Patient May Have . . .
- Productive cough, worse in the morning.
- Hemoptysis.
- Chest pain, SOB.
- For tuberculous meningitis: persistent or intermittent headache, subtle changes in mental status, low-grade or no fever.
- For skeletal tuberculosis: back pain, lower extremity paralysis, arthritis.
- Fever, night sweats.
- Extreme weight loss if disease is advanced.

Immediate Interventions
- Institute airborne precautions (see Airborne Precautions in this tab); move patient to private room with negative pressure.
- Obtain high-efficiency disposable masks for staff.
- Assess sputum production and patient’s ability to clear airway.
- Auscultate lungs for possible diminished breath sounds, bronchial breathing, and coarse crackles.

Focused Assessment
- Assess findings of chest x-ray: cavitation, calcification (indicates healed disease), and nodes in the upper lobes suggest pulmonary TB.
- Check temperature; ask about night sweats.
- Ask about recent travel.
Stabilizing and Monitoring

Prompt isolation to prevent transmission; initiate multiple drug therapy.

- Obtain early morning sputum specimens for 3 days for culture and acid-fast bacilli (AFB). Obtain proper medium for AFB specimen.
- Administer standard therapy, and teach patient that it is critical to take medications as prescribed for the duration of therapy (6–18 months). A combination of the following drugs is standard treatment:
  - Isoniazid (INH).
  - Rifampin (RM).
  - Pyrazinamide (PZA).
  - Ethambutol (EMB).
  - Vitamin B₆ for neuropathy of hands/feet.
- Assess for signs and symptoms of tuberculosis outside the lungs (meningitis, peritonitis, renal or bone involvement, pericarditis).
- Continue isolation until three consecutive sputum samples are negative for AFB.

Be Prepared To

- Assist with bronchoscopy.
- Assist with chest tube placement (ruptured TB granuloma, empyema).

Possible Causes

- Mycobacterium tuberculosis.

Preventing the Spread of Infections

Standard Precautions

Use standard precautions for the care of all patients. Add contact, droplet, or airborne precautions, as needed and depending on the mode of transmission.

Hand Washing

- Wash hands:
  - After touching blood, body fluids, secretions, excretions, and contaminated items.
  - Immediately after gloves are removed.
  - Between patient contacts.
  - To avoid transfer of microorganisms to other patients or environments.
Between tasks and procedures on the same patient to prevent cross contamination of different body sites.

**Gloves**
- Wear clean, nonsterile gloves:
  - When touching blood, body fluids, secretions, excretions, and contaminated items.
  - Before touching mucous membranes and nonintact skin.
- Change gloves between procedures on the same patient after contact with contaminated material.
- Remove gloves promptly after use and before touching noncontaminated items and environmental surfaces. Wash hands immediately.

**Mask, Eye Protection, Face Shield**
- Wear mask and eye protection or face shield when patient-care activities are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.

**Gown**
- Wear a clean, nonsterile gown when patient-care activities are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.

**Patient-Care Equipment**
- Prevent skin, mucous membrane, and clothing exposure to contaminated equipment.
- Do not use reusable equipment for another patient until cleaned appropriately.
- Discard single-use items properly.

**Linen**
- Prevent skin, mucous membrane, and clothing exposure to contaminated linen.

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**Airborne Precautions**

For patients who are or may be infected with microorganisms transmitted by airborne droplet nuclei.
- Private room with:
  - Monitored negative air pressure in relation to the surrounding area.
• Six to 12 air changes per hour.
• Monitored high-efficiency filtration of room air.
• Door closed.
• Keep patient in room.

**Droplet Precautions**

For patients who are or may be infected with microorganisms transmitted by large-particle droplets that occur with coughing, sneezing, talking.

• Private room or in room with patient who has active infection with same microorganism but no other infection.
• If private room not possible, maintain at least 3 ft of space between infected patient and other patients and visitors.
• Door may be open.
• Wear a mask when working within 3 ft of patient.
• Place mask on patient when he or she must leave the room.

**Contact Precautions**

For patients who are or may be infected or colonized with microorganisms transmitted by direct contact with the patient or indirect contact with environmental surfaces or patient-care items.

• Private room or in room with patient who has active infection with same microorganism but with no other infection.
• Wear clean, nonsterile gloves when entering the room.
• Remove gloves before leaving patient room, and immediately wash hands with antimicrobial or waterless antiseptic agent.
• Do not touch potentially contaminated surfaces once gloves are removed and hands washed.
• Wear clean, nonsterile gown when entering room if clothing will have contact with patient, surfaces, or items in the room or if patient is incontinent or has diarrhea, an ileostomy, a colostomy, or wound drainage not contained by a dressing.
• Remove the gown before leaving room.
Rapid Assessment in Urgent/Emergent Situations

- An emergency on a medical-surgical unit generally means a patient has had either cardiac or respiratory arrest or is rapidly decompensating.
- Urgent situations generally are a sudden worsening in condition, an acute change in mental status, or development of a serious complication but without an imminent threat to life.
- This discussion focuses on what the staff nurse does, not what an intensive care unit (ICU) or emergency department nurse would do. It follows the same principals as an ICU assessment but acknowledges the floor nurse’s scope of practice (see What to Do If Your Patient Codes in this tab).

**QI SI** Always time-document your assessments and interventions, the patient’s response, notification of physician/intern/nurse practitioner (NP) or physician’s assistant (PA), and his or her response.

**RI** Do not hesitate to page a physician or activate the rapid response team if you have concerns about a change in the patient’s condition. *It is your legal and ethical duty to get help!*

### Airway, Breathing, Circulation

- When there is a sudden change in condition, your first focus is assessing airway, breathing, and circulation (ABC). As you assess ABC, assess mental status as well (D for disability).

**RI** ALWAYS reassess airway breathing and circulation as the situation evolves—if something changes in ABC, refocus your attention to these basics, notify the physician, and/or call a CODE.

**A: Airway Assessment: Is the airway clear?**

- If the patient is awake, has spontaneous respirations, and can speak normally, the airway is not obstructed. Proceed to assessing breathing/oxygenation status.
- Partial airway obstruction can be caused by a foreign object, the tongue, edema, infection, or secretions. It can progress quickly to complete obstruction. In a conscious patient, signs and symptoms include:
  - Marked respiratory distress
  - Altered voice
  - Difficulty swallowing and/or painful swallowing
Hand-to-throat universal choking sign
■ Stridor
■ Facial swelling, prominent neck veins

The obtunded, sedated, or unconscious patient with a partially obstructed airway may have noisy respirations, snoring, gasping, or stridor. With complete obstruction, there will be no sound.

Assess airway by looking in the oropharynx for foreign objects, secretions, or vomitus and listening for abnormal sounds in the upper airway, such as wheezing or stridor indicating a foreign object, or harsh crackles, indicating copious secretions. Check and clear the oropharynx with a finger sweep.

Once the airway is determined to be clear, put the patient in high Fowler’s to maintain airway patency.

Interventions Related To Airway Patency
■ If the airway is partially obstructed but the patient is alert and can cough to clear it, do not interfere. Nevertheless, be prepared to initiate the Heimlich maneuver and get help if obstruction becomes complete.

If the patient cannot speak but is conscious and gesturing that he or she is choking, call for help and initiate Heimlich maneuver/choking intervention per current basic life support guidelines (see Heimlich position in this Tab).

If the airway is obstructed and the patient is unconscious, initiate protocols to clear the obstruction (i.e., finger sweep or Heimlich maneuver).

If you cannot palpate a pulse, begin cardiopulmonary resuscitation (CPR) by giving 30 high-quality chest compressions. Try to give two rescue breaths after the compressions, but even if you cannot ventilate the patient, there will be enough oxygen left in the blood to last a few minutes. Continue with chest compressions.

Once the code team arrives, they will either intubate the patient or perform a tracheotomy.

B: Breathing Assessment
■ Assess rate and ease of breathing, if the patient is using accessory muscles, if breaths are shallow or deep, and if the pattern of exhalation and inhalation is normal.
■ Feel trachea and examine the chest. The trachea should be midline, and both sides of the chest should rise and fall equally.
■ Auscultate the lungs. Note if breath sounds are equal bilaterally and if you hear crackles or areas where breath sounds are diminished or absent.
Check skin color, nail beds, and circumoral area for cyanosis.
Check pulse oximetry results and, if available, arterial blood gas (ABG) results.

**Interventions Related To Breathing**
- Provide high-flow supplemental O₂ (if the patient has chronic obstructive pulmonary disease [COPD], use low-flow O₂).
- Have patient sit up in bed or assume a position the patient feels is best to facilitate ventilation.
- **RI** Notify physician STAT if the patient is in acute distress and document.
- Stay with the patient (see Dyspnea/SOB in Respiratory tab for more information).

**C: Circulation Assessment**
- Check heart rate (HR) and blood pressure (BP) and document; recheck at least every 10 min until patient stabilizes.
- Check capillary refill time and peripheral and central pulses.
- Assess skin temperature, color, and degree of moistness. Blue, dusky, or ashen color or red, mottled appearance indicate poor perfusion. Clammy, cool, moist skin can indicate hypotension and shock.

**Interventions Related To Circulation**
- If the patient is hypotensive, elevate legs to enhance venous return.
- Place patient on cardiac monitoring if available.
- Reassess HR and BP every few minutes to determine whether the patient’s cardiovascular status is stable.
- Assess for a patent intravenous (IV) access. If the patient does not have one, insert at least one large-bore IV, two if possible, and hang normal saline at rate specified by physician. (You must get an order for an IV first.)
- Check all drains, arterial puncture sites, and incisions; if the patient is bleeding, apply pressure to control it.

**D: Disability Assessment**
- Disability in this context refers to neurological status.
- A rapid, limited assessment involves checking pupil responsive and assessing level of consciousness (LOC) using the AVPU scale:
  - A = Alert
  - V = responds to Voice
  - P = responds to Pain
  - U = Unresponsive
- **RI** Any change in AVPU requires reassessment of ABC.
- On a medical-surgical unit, assess responsiveness as described, but also assess whether the patient is restless, agitated, anxious, fearful, etc.
Restlessness, which should not be confused with agitation (anger) or anxiety (fear), can be a serious sign of impending rapid deterioration in the patient’s status. Agitation and anxiety are important to note, but a patient who is truly restless, moving about in bed, possibly moaning or able to talk but unable to focus on what you are saying, especially associated with change in vital signs and skin color, is most likely extremely ill. Get help STAT!

■ Unless you have never cared for the patient before, you can assess how much the patient's current neurological status deviates from his or her baseline. Ask the standard orientation questions (see tab 3, Rapid Neurological Assessment).

■ As you are assessing other parameters, ask about any unusual sensations, numbness, weakness, etc., to evaluate likelihood of a cerebral vascular problem. Ask the patient to move all four extremities.

**Now What?**

■ Because you have already done ABCD assessment, you should have a sense whether the neurological, respiratory, or cardiovascular systems are involved; how serious the problem is; and how urgently you need to contact the physician.

■ If you haven’t called yet, briefly stop now and ask yourself:
  ■ Do I need to call a code?
  ■ Should I get somebody to bring the code cart to the room?
  ■ Do I need to call the physician to the unit?
  ■ Should I call respiratory therapy (RT) to the unit?
  ■ Can I call the doctor in a few minutes after gathering more information?
  ■ Who can I call to cover my other patients?
  ■ What other information do I need?
  ■ What can I do right now to be prepared?

■ The topic that follows the Focused Secondary Survey, Detecting an Impending Emergency, will help guide your decision.

### Focused Secondary Survey

■ Only when it is established that ABC are not dangerously impaired do you perform a secondary assessment: a focused assessment to determine underlying and contributing problems.

■ In the emergency department, the secondary survey follows the primary survey and resuscitation.

■ It involves a head-to-toe systematic assessment to detect injury, hemorrhage, altered perfusion, and altered function.
The focus of the secondary assessment on a medical-surgical unit is different because the patient’s history and diagnosis are usually known and traumatic, high-force injury is not a factor.

**Rapid Focused Assessment**

- If the problem came to your attention because the patient called you with a specific complaint, begin your assessment there and then quickly assess other systems. (See individual tabs for rapid assessments.)
- If you discovered a serious problem and the patient is not well enough to be aware of the problem (e.g., a disoriented patient who has a seizure, abnormal vital signs, distended abdomen, blackened or grossly discolored extremity, wound dehiscence, or melanotic stool), follow the usual head-to-toe approach.
- Get as accurate a description of the pain or symptom as you can.
- Remember that pain in the chest and back can come from a number of different organs—heart, lungs, gallbladder, pancreas, stomach, intestines, etc.—or from muscle, bone, or cartilage. Remember that pain radiates and may not be originating from the area where it is felt.
- Continue to assess breathing, HR, BP, and mental status. Assess temperature once.
- Assess for sources of infection.
- Is the patient diabetic? What was the last glucose level?
- Check recent laboratory tests and input and output (I&O).
- Determine whether urine output has been at least 30 mL/hr in the preceding 24 hours.
- Consider what tests or procedures the patient has had and whether they can be contributing to the problem.
- Consider what medications have been given recently, including IV fluids, total parenteral nutrition, and test preparation contrast.
- If you did not need to notify the physician earlier, do so now, making sure to present the information thoroughly and concisely (see How to Report an Urgent Problem).

**Detecting an Impending Emergency**

- Patients typically go through several hours of subtle changes in condition before an emergency becomes full-blown.
- HR and BP changes, changes in mentation, breathing difficulties, and other signs precede a full-blown code.
Intervening earlier in the downward spiral of events vastly increases the patient's chance of survival.

**R1** The nurse's role is absolutely critical in recognizing that adverse changes in the patient's condition are occurring, initiating interventions to counteract these changes and summoning to the bedside practitioners who can order the higher level interventions necessary to rescue the patient.

The term “failure to rescue” is used by institutions that monitor health care quality to describe situations in which hospital staff did not recognize clinically important changes in a patient’s condition or did not act effectively in summoning help. The term connotes an end result of death or permanent disability. It may reflect the quality of monitoring, the effectiveness of actions taken once early complications are recognized, or both. **See Early Warning Tool** in the Tools tab for specific clinical changes that warrant intensified monitoring, a higher acuity setting, and/or immediate medical or surgical intervention. See information that follows for general guidelines.

**Red flags that require immediate assessment, intervention, and physician notification include:**

- Drop or acute rise in BP or mean arterial pressure (MAP) <70 mm Hg or >130 mm Hg.
- Systolic BP ≤90 mm Hg or ≥200 mm Hg; diastolic BP ≥110.
- Heart rate <50 or >130 beats/min.
- Respiratory rate <10 or >30 breaths/min.
- Patient or family feeling that something is wrong; sense of impending doom.
- Extreme anxiety, restlessness.
- Chest pain.
- New onset of breathing difficulty or pulse oximetry <88% for >5 min.
- Change in level of consciousness.
- New onset of abdominal pain.
- New onset of confusion, lethargy, restlessness, or agitation.
- Cyanosis, ashen or pale appearance of patient or an extremity, cold and clammy skin.
- New onset of facial drift, arm drift, changes in speech, blurry vision.
- Urine output <60 mL over 4 hr with no history of renal disease.
- Failure to respond to treatment; worsening condition.
Abnormal laboratory values such as:

- White blood cell count $\geq 15,000$; neutrophils $\leq 1,000$; platelets $< 20,000$.
- Acute drop in hemoglobin (Hgb) to 8–10 g or chronically low Hgb that drops to $< 8$ g.
- Acute drop in $\text{SaO}_2$ to $\leq 94\%$.
- For patients with chronically low $\text{SaO}_2$, a drop of 2% below usual level is an acute drop (e.g., if $\text{SaO}_2$ in a COPD patient is 91%, an $\text{SaO}_2$ of 89.2% is a 2% drop).
- Elevated troponin $\geq 0.40 \text{ ng/mL}$.
- INR $> 5$, PTT $> 120$ sec.
- ABG results: pH $< 7.20$ or $> 7.58$, pCO$_2$ $< 9 \text{ mmHg}$ or $> 65 \text{ mmHg}$, pO$_2$ $< 40 \text{ mmHg}$.
- Glucose $\geq 400 \text{ mg/dL}$ in diabetics, $\geq 300 \text{ mg/dL}$ in nondiabetics, or $< 50 \text{ mg/dL}$.
- Potassium $< 2.5 \text{ mEq/L}$ or $> 6.0 \text{ mEq/L}$; sodium $< 120 \text{ mEq/L}$ or $> 160 \text{ mEq/L}$.

**Interventions**

- Assess the patient rapidly, focusing on perfusion and oxygenation; assess VS; note whether there is a patent IV access; if on supplemental O$_2$, make sure it is on and functioning.
- Call physician, PA, or NP to report the patient’s condition.
- Ask if you should start an IV if there is no current access or if you should hang IV fluids, obtain blood for laboratory work, call for RT or electrocardiogram, begin supplemental O$_2$ if not already on, or administer any medications.
- If medication is ordered, read back the verbal order and spell out the dose to avoid any confusion.
- Perform any actions ordered.
- Stay with the patient until physician, PA, or NP arrives.
- Notify your supervisor that you need someone to cover your other patients until the situation stabilizes.
- Continue to assess VS as indicated by patient’s condition.
- Prepare to transfer patient to higher level of care.

**How To Report an Urgent Problem**

Follow this format to report urgent problems clearly and concisely.
(Acronym to remember: NETDOC.)

- **Name yourself and the patient.**
  - Give your full name, your role (RN).
  - Give the patient’s name and location.
Describe Emergency.
- Is the patient stable but in danger of declining soon?
- Is the patient unstable?

Describe the Trigger.
- What happened to alert you to the problem?
- What was the patient’s complaint, or how did you find the patient?

Provide the Details.
- Relate your assessment findings specific to the problem; include relevant laboratory work.
- What are the patient’s VS, and have they been stable?
- What is the patient’s respiratory status and pulse oximetry?
- What interventions have you taken, and what were the effects?

Request Orders.
- Ask for any orders you need (IV access, O₂, etc.).
- Ask what the physician would like you to do next.

Determine Continuing Plan.
- Ask when someone will arrive to see the patient.
- Ask what the treatment plan will be.

What to Do If Your Patient Codes

If you are by yourself:
- Establish unresponsiveness, call for help, and check ABC; clear airway by sweeping your fingers in the patient’s mouth or by suctioning.
- If you have no help, call the code before proceeding. As you do this, pull the call bell out so that the light flashes continually, ask any visitors to wait outside the room, and pull the curtain if another patient is present.
- Note if the patient has a running IV or an IV access device.
- Place the patient in a supine position in bed if possible.
- Place the arrest board under the patient’s back if you have help. If not, proceed until a second person arrives.
- Next, assess breathing for 5 sec, using the head-tilt/chin-lift maneuver (see next figure, top left). If the patient is not breathing, initiate ventilations, preferably with a bag-valve-mask device. If one is not available, quickly apply a barrier, and give two breaths of 1.5–2 sec each.
- Check for a pulse. If the patient has no pulse, begin one-person CPR until another person or the code team arrives (see CPR Quick Reference in this tab).
When another nurse arrives to help:
■ Bring the crash cart into the room.
■ Get an IV of NS running.
■ Switch to bag-valve-mask ventilations by:
  ■ Inserting an oral airway.
  ■ Connecting the bag-valve-mask to oxygen tubing.
  ■ Setting up the flowmeter.
  ■ Turning on the oxygen to 12–15 L/min.
■ Ensure seal around the patient’s airway is tight, and resume CPR.
■ After the code team arrives, someone will relieve you and begin other resuscitative interventions.
■ After you are relieved:
  ■ Make sure one nurse is documenting and another nurse is retrieving medications and supplies as needed from the code cart.
  ■ Stay in the room to be available to the team.
  ■ Many other tasks may be required of you in a code situation, including obtaining blood and transporting it to the laboratory, inserting an IV or Foley catheter, suctioning the airway, administering medications, calling the attending physician, arranging for a bed in the ICU, etc. Do not practice beyond your level of expertise.
  ■ Offer support to any visitors who are present.
  ■ Document all events up to and including time code was called.
    Document after time the code ended. Check that the code record is complete and on the chart.
■ If the patient survives, write a transfer note and give report to receiving unit. If you work in an ICU and the patient is not being moved, detail the events in your end-of-shift report and document on the ICU flowsheet.
■ If the patient does not survive, leave all tubes in place and check with your supervisor to determine what can be removed. If an autopsy will be performed, you will not remove anything.
■ Clean and cover the patient, and straighten the room before the family views the body. If family members were present at the time the patient coded, sensitively ask them if they would like you to do this first. It may be unbearable for them to wait. ALWAYS consider the family’s needs first.
Adult/Child CPR, Heimlich, and Recovery Positions

Head—tilt, chin—lift.

Hand placement.

Heimlich maneuver: abdominal thrusts if unresponsive.

Jaw thrust maneuver.

Heimlich maneuver.

Recovery position.
Infant CPR and Heimlich Positions

Head—tilt, chin—lift.

CPR hand placement.

Heimlich maneuver: back blows; support head.

Heimlich maneuver: chest thrusts; support head.
CPR Quick Reference—Lone Rescuer

1. Get help: Call 9-1-1 or activate facility code system.
2. Assess for pulse for 10 sec only. If no definite pulse is felt, begin chest compressions not rescue breaths as previously recommended.
3. Administer chest compressions.
   ■ Effective compressions are essential! Place hands over lower half of sternum and push hard and fast to achieve a rate of 100 compressions per minute and a compression depth of at least 2 inches (5 cm).
   ■ Allow complete recoil of the chest between compressions so the heart has a chance to fill.
   ■ Compression to ventilation ratio is 30:2.
4. Give two rescue breaths by mouth-to-mouth or bag-mask.
   ■ Give each breath over one second.
   ■ Each breath should cause the chest to rise visibly.
5. Continue until emergency medical services/code team arrive to take over.

Choking Quick Reference

Conscious Patient

1. Assess for airway obstruction.
   ■ Adult or child: ask victim if he or she is choking; can he or she speak or make any sounds?
   ■ Infant: Cannot cry or ineffective cough.
2. Attempt to relieve obstruction.
   ■ Adult or child: abdominal thrusts until the obstruction is relieved or victim becomes unresponsive (see step 3).
   ■ Pregnant or obese patients: Chest thrusts until the obstruction is relieved or the patient becomes unresponsive (see step 3).
   ■ Infant: Five back blows and five chest thrusts until the obstruction is relieved or victim becomes unresponsive (see step 3).
Unresponsive Patient

1. **Determine unresponsiveness.**
   - Adult: get help or call 911 before any intervention.
   - **Child or infant:** get help or call 911 after 1 min.

2. **Open airway.**
   - Head—tilt, chin—lift.
   - If trauma suspected, use the jaw-thrust method.

3. **Assess breathing and attempt to ventilate.**
   - If unsuccessful, reposition airway, and reattempt ventilation.
   - If still unsuccessful, begin CPR (for all ages).

4. **Inspect mouth and remove obstruction.**
   - Adult, child, and infant: Use a tongue-jaw lift while opening the airway during CPR.
   - Perform a finger sweep only to remove a visible foreign body.

5. **Repeat maneuvers.**
   - Inspect, sweep, ventilate.
   - Perform CPR until obstruction relieved.
   - **Note:** if patient resumes breathing, place into recovery position, and reassess ABC every minute.

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**Automatic External Defibrillators (AED)**

- Assessment: determine unresponsiveness and assess ABC.
  - Children 1–8 years: get help/AED after 2 min of CPR.
  - Adults ≥8 years: get help/AED immediately.
- Perform CPR until AED arrives.
- **Power:** turn on the AED, and follow voice prompts.
- **Attach pads:** stop CPR, attach pads to patient, making sure pad cables are plugged into the AED unit. Follow AED instructions for pad placement.
- **Analyze:** press the Analyze button, and wait for instructions (do not make contact with patient while AED is analyzing rhythm).
- **Shock:** announce “Shock indicated, stand clear,” and assure that no one is in contact with the patient.
- Fully automatic units analyze rhythm and shock if indicated.
- Semiautomatic units analyze rhythm, and then instruct the operator to press the Shock button if indicated.
Anaphylaxis

The Patient May Have...
- Flushing, tingling, shortness of breath (SOB).
- Abdominal cramps, palpitations, syncope.
- Hives, itching.
- Feelings of impending doom, anxiety, restlessness.
- Bronchospasm, laryngeal edema, respiratory distress; feeling of “lump in throat.”
- Hypotension, dysrhythmia.

Immediate Interventions

**SI**  **QI** Turn off blood products or any infusing medications, especially antibiotics or IV fluids with Dextran. Hang a bag of normal saline with new tubing to maintain the IV site.

**RI** Ask physician about administering epinephrine. Epinephrine treats anaphylactic shock by constricting peripheral blood vessels, increasing cardiac output, relaxing airways, and preventing additional release of inflammatory mediators.

- Assess airway. Administer high concentrations of supplemental O₂.

**RI** Call physician and respiratory therapist or anesthesiologist STAT! Get other nurses to help. Have someone bring code cart or emergency medications box to room.

**QI**  **SI** Epinephrine is a high alert medication and comes in two very different strengths. Epinephrine 1:10,000 yields 0.1 mg/mL. Epinephrine 1:1,000 yields 1 mg/mL and is appropriate for adult intramuscular (IM) injections. Usual adult dose is 0.3–0.5 mg IM. Do not give 1:1,000 dilution by direct IV. Mistakes can be rapidly fatal.

- Using epinephrine 1:1,000, draw up correct dose and give IM into the vastus lateralis muscle (anterior-lateral thigh). Dose can be repeated every 5 min three or four times depending on clinical response. **SI** Double-check with another practitioner the dilution, the dose, and the correct number of mL to withdraw.

- Initiate continuous cardiac and VS monitoring.
- Obtain two large-bore IV access sites.
- Anticipate need for mechanical ventilation.
- Assess recent exposure to allergen (food, insect sting, medication, blood product, contrast medium, latex).
- Document patient’s status, phone call to physician, and physician response. Continue to time-document all interventions and the patient’s response.
Focused Assessment
- Reassess airway, LOC, and VS (HR, RR, BP) on a continuous basis.
- Assess SaO₂ via pulse oximetry.
- Assess skin color, temperature, turgor, moistness, and capillary refill.

Stabilizing and Monitoring
- Reversal of anaphylaxis with early administration of epinephrine; circulatory support with IVFs.
- Monitor VS every 5 min or more frequently.
- Administer medications, IV fluids as ordered.
- Provide emotional support to family/patient.
- Record patient’s status in chart, and communicate to physician.

Be Prepared To
- Administer epinephrine IM.
- Call a code.
- Assist with intubation and airway management.
- Assist with obtaining central venous access.
- Administer IVFs and medications (vasopressors, diphenhydramine, steroids, volume expanders).
- Transfer patient to ICU.

Possible Causes
- Exposure to antigen.

Transfusion Reaction
- Transfusion of blood products carries numerous risks and potential complications:
  - Acute hemolytic transfusion reactions (AHTR) occur when donor red blood cells are destroyed by the recipient’s antibodies due to a mismatch between donor and recipient blood type. These reactions can be fatal and often result from a clerical error that occurs when blood is drawn for the type and cross match, when donor blood is labeled in the blood bank, or when nurses perform the pretransfusion check. Always have a second nurse check the order, the patient’s hospital bracelets, the bar code and all identifying details before starting the transfusion. Symptoms include a fever that spikes dramatically within the first 15 min of the transfusion, rigors, abdominal discomfort, and rapid drop in BP.
  - Transfusion-related sepsis (TRS) occurs when donor blood contains bacteria that overwhelm the recipient. Very early in the transfusion the recipient develops fever, abdominal cramps, rigors, and shock.
Disseminated intravascular coagulopathy (DIC) often ensues. Occurs more frequently with platelet transfusions.

- **Transfusion-related lung injury (TRALI)** is the most common cause of death related to transfusions. New onset of lung injury occurring within 6 hrs of transfusion, hypoxemia, bilateral lung infiltrates (pulmonary edema), and no other risk factors for these findings indicates TRALI. Fever and chill occur somewhat later than the fever and chills of AHTR and TRS. SBP may be elevated initially, but quickly drops below baseline.

- **Allergic reactions** can occur and are characterized by hives, itching, low BP, and respiratory distress. Treatment for transfusion allergic reaction is the same as for other acute allergic (anaphylactic) reactions.

- **Delayed hemolytic reactions (DHR)** are also caused by mismatched blood type, but the symptoms and consequences are much milder and occur after 24 hr posttransfusion.

- **Febrile nonhemolytic reactions** are the most common and occur with platelet transfusions. Fever develops later in the transfusion and chills are mild. These reactions develop when donor white blood cells release pro-inflammatory chemicals during storage. The patient develops a fever but none of the other serious signs of a hemolytic reaction. The transfusion can be given as long as a hemolytic reaction is ruled out.

**The Patient May Have . . .**

- Fever, chills, tachycardia, hypotension, abdominal cramps.
- Chest pain, SOB.
- Apprehension, restlessness.
- Urticaria, pruritus, skin erythema.
- Flank, back, or joint pain.

**Immediate Interventions**

RI   Stop the transfusion STAT! Run normal saline with new tubing through the IV to maintain IV access.

- Assess ABC. Get help.
- Recheck patient ID and blood labels for error. Notify blood bank of reaction.
- Check VS and assess skin color, moisture, and temperature. If the patient is cool, pale, and sweaty and the systolic blood pressure is more than 10 mm Hg below baseline or if it is ≤90 mm Hg, lower head of bed and temporarily increase rate of IV normal saline to 100 to 125 mL/hr to help maintain blood pressure. Call physician, PA, or NP STAT. Report your findings and that you increased IV rate.
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- Administer supplemental O₂.
- Notify physician, PA, or NP if you have not already.
- Document patient’s status, phone call to provider and provider’s response.

**Focused Assessment**

- Reassess LOC, orientation, and VS (temperature, HR, RR, BP).
- Assess SaO₂ via pulse oximetry if available.
- If patient on telemetry or cardiac monitor, assess rhythm strip.

**Stabilizing and Monitoring**

- Administer prescribed medications and O₂.
- Return unused portion of blood product to blood bank for analysis.
- Continue to monitor VS, temperature, respiratory status, LOC, and urine output.
- Chart patient status, and convey to physician, PA, or NP.

**Be Prepared To**

- Administer epinephrine, treat shock, initiate CPR if necessary.
- Administer IV fluids.
- Insert indwelling catheter to monitor hourly urine output.
- Administer medications such as:
  - Antihistamine, antipyretic, steroids, and furosemide (Lasix) IV.
  - Acute hemolytic reaction: IV normal saline with diuretics to maintain urine output of 100 mL/hr.
  - Allergic response: corticosteroids such as Solu-Medrol.
  - Urticaria: diphenhydramine 25–50 mg IV, deep IM.
  - Fever: acetaminophen.
  - Septicemia: antibiotics, IV fluids, vasopressors.
  - Kidney failure and shock: IV fluids and vasopressors.
- Obtain or order laboratory tests.
- Titrate O₂ to keep SaO₂ >90%.
- Insert O₂ to keep SaO₂ >90%.
- Insert two large-bore IV accessories.

**Possible Causes**

- ABO incompatibility, blood contamination, allergic response.

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**Shock**

- The term “shock” indicates that the patient’s circulatory system is profoundly disturbed. The volume of circulating blood and the size of the vascular bed are no longer in balance.
There may be insufficient blood volume, as in hemorrhage, or sufficient volume but massively dilated peripheral blood vessels, as in sepsis. This causes blood to pool in the peripheral tissues, leaving too little blood circulating.

Additionally, the heart may be unable to pump blood effectively, which is directly affected by the tone of the systemic circulation and the amount of circulating blood.

**Systemic and Cellular Effects**

- Whatever the cause of shock, stroke volume drops, cardiac output drops, BP drops, and cells receive less O₂.
- When the amount of O₂ is insufficient, cells can no longer aerobically metabolize glucose to manufacture energy. Instead, cells switch to anaerobic metabolism, which is inefficient and produces lactic acid. (Recall that aerobic metabolism yields 36 molecules of adenosine triphosphate [ATP] from one molecule of glucose, whereas anaerobic metabolism yields only 2.) Energy for basic cellular functions declines drastically and cells die. The dying cells release enzymes and inflammatory substances into the blood.
- At the same time, the poorly perfused liver cannot function well, causing toxins such as ammonia and bilirubin to accumulate in the blood. The acidic by-products and lactic acid from anaerobic metabolism upset the pH balance, which creates additional stressors on the system.
- Without appropriate intervention and relief of the underlying cause, and sometimes despite appropriate intervention, shock is fatal.

**The Patient May Have . . .**

- Restlessness and anxiety (early), lethargy, and coma (later).
- Hypotension, MAP <70 mm Hg (MAP <50 is insufficient to maintain cerebral and coronary blood flow).
- Cool, pale, mottled, or cyanotic skin (hypovolemic shock).
- Rapid, shallow respirations.
- Decreased urine output.
- Tachycardia (bradycardia in neurogenic shock).
- Delayed capillary refill (>3 sec), diminished peripheral pulses (<+2).
- Diaphoresis.
- Throat tightness, stridor, flushing, urticaria (anaphylactic shock).

**Immediate Interventions**

- Call physician, PA, or NP STAT! Get help from other staff.
- Establish whether the patient can maintain his or her airway.
- If necessary, insert a nasal or oral airway, and suction oropharynx if needed.
Administer high-flow O₂ via nonrebreather mask (10–15 L/min), or manually assist ventilations with an Ambu-bag (mask-valve device).

Anticipate need for mechanical ventilation.

Obtain IV access.

Set up cardiac monitoring.

Place patient in a supine position with legs elevated above heart level to increase circulation to vital organs. **Note:** this position is contraindicated if the airway is compromised; to maintain airway patency, place patient in low Fowler’s position (HOB slightly elevated).

Control bleeding with direct pressure if patient is hemorrhaging.

Document patient’s status, phone call to physician, PA, or NP, and provider’s response.

**Focused Assessment**

- Assess LOC, orientation, and VS (HR, RR, BP).
- Assess SaO₂ via pulse oximetry if available (may be unreliable due to decreased peripheral perfusion).
- Assess skin color, temperature, turgor, moistness, and capillary refill.
- Evaluate previous 24-hour I&O.

**Stabilizing and Monitoring**

- **Establish cause of shock and initiate treatment; correct hypoxia, restore blood pressure; maintain adequate cardiac output; correct acid-base imbalance; prevent end-organ damage.**

- Monitor VS every 5 minutes or more frequently.

Manage various types of shock accordingly:

- **Hypovolemic:** O₂; IVF; volume replacement with crystalloids, colloids, plasma volume expanders, and/or blood; elevate lower limbs (if not contraindicated); control bleeding; arterial line placement.

- **Cardiogenic:** O₂; IVF; vasopressors, cardiotonics, antidysrhythmics (i.e., dopamine, dobutamine, lidocaine); correct dysrhythmias; arterial line placement and hemodynamic monitoring.

- **Septic:** O₂; IVF; volume replacement; antibiotics, vasopressors, antipyretics; arterial line placement.

- **Anaphylactic:** O₂; IVF; epinephrine, antihistamines (Benadryl/Atarax), steroids; intubation and airway management; arterial line placement.

- **Neurogenic:** O₂; IVF; spinal stabilization; vasopressors; intubation and airway management; arterial line placement; insert Foley’s catheter.

- Provide emotional support to family/patient.

- Record patient’s status in chart, and communicate to physician, PA, or NP.
Be Prepared To
- Call a code and assist with intubation and airway management.
- Assist with obtaining central venous access.
- Administer fluids, blood products, and medications as ordered.
- Order or obtain specific laboratory tests to be drawn (Hgb, hematocrit, WBC, cardiac markers, electrolytes, ABG, urine analysis).
- Transfer to ICU.

Possible Causes
- Blood loss, vomiting, dehydration (hypovolemic shock), myocardial infarction (MI), profound bradycardia or tachycardia, pump failure (cardiogenic shock), infection, endo/exotoxin release (septic shock), exposure to antigen (anaphylactic), spinal cord injury, anesthesia (neurogenic shock), drug overdose.

### Comparison of Different Types of Shock States

<table>
<thead>
<tr>
<th>Type</th>
<th>Pathophysiology</th>
<th>Signs and Symptoms</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anaphylactic:</strong></td>
<td>Acute, life-threatening allergic reaction to a specific antigen.</td>
<td>Respiratory distress (stridor); ↓ BP; edema; rash, hives; cool, pale skin; possible seizure activity, tight chest.</td>
<td>O₂, airway management, epinephrine, antihistamines, steroids, IV fluids.</td>
</tr>
<tr>
<td></td>
<td>Massive vasodilation; ↑ capillary permeability, ↓ tissue perfusion.</td>
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<tr>
<td><strong>Cardiogenic:</strong></td>
<td>Pump failure due to MI, pulmonary embolism (PE), cardiac tamponade, heart failure.</td>
<td>↓ Cardiac output due to lack of contractile force to create BP; ↓ tissue perfusion.</td>
<td>Hypotension, weak pulse, tachycardia, clammy skin, altered LOC; dysrhythmias. O₂, IV fluids, vasopressors, cardiotonics, antidysrhythmics.</td>
</tr>
</tbody>
</table>

Continued
Comparison of Different Types of Shock States—cont’d

<table>
<thead>
<tr>
<th>Type</th>
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<th>Signs and Symptoms</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypovolemic:</td>
<td>↓ circulating volume due to hemorrhage, dehydration, third spacing of fluids, burns.</td>
<td>Hypotension; tachycardia; weak pulse; ↓ capillary refill; cyanosis; dysrhythmias; altered LOC; cool, clammy, pale skin.</td>
<td>$O_2$, control bleeding, fluid replacement with crystalloids, colloids, volume expanders, blood.</td>
</tr>
<tr>
<td>Neurogenic:</td>
<td>Loss of vascular tone; profound vasodilation; ↓ venous return; ↓ cardiac output; ↓ tissue perfusion.</td>
<td>Hypotension, bradycardia, or tachycardia; tachypnea; possible flaccid paralysis and absent reflexes.</td>
<td>$O_2$, IV fluids, airway management, spinal stabilization, possible vasopressors.</td>
</tr>
<tr>
<td>Septic:</td>
<td>Circulatory failure due to massive vasodilation; ↓ venous return; capillary leak syndrome; ↓ tissue perfusion.</td>
<td>Fever or low temperature; bounding pulse; ↓ urine output; flushed, warm, moist diaphoretic skin; increased HR/RR.</td>
<td>$O_2$, IV fluids, blood cultures, urine analysis, sputum culture and sensitivity, antibiotics, vasopressors.</td>
</tr>
<tr>
<td>Drug</td>
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<td>Adenosine</td>
<td>PSVT, Cardiac arrest, VT, VF, AF, SVT, and PSVT</td>
<td>2-20 mcg/kg/min.</td>
<td>H/F, low CO, hypotension, AV block, paroxysmal tachycardia, wide QRS tachycardia.</td>
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<td>Amiodarone</td>
<td>A-flutter, ventricular tachycardia, atrial fibrillation, paroxysmal tachycardia</td>
<td>150 mg IV in 10 min.</td>
<td>Avoid in WPW, wide QRS tachycardia, negative inotropic effect, increased myocardial demand, causes hypoxia.</td>
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<td>Atropine sulfate</td>
<td>A-flutter, ventricular tachycardia, atrial fibrillation, paroxysmal tachycardia</td>
<td>150 mg IV in 10 min.</td>
<td>Avoid in WPW, wide QRS tachycardia, negative inotropic effect, increased myocardial demand, causes hypoxia.</td>
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<td>Calcium chloride</td>
<td>Hypocalcemia, hypotension, nausea, vomiting, muscular weakness,</td>
<td>100 mg/min</td>
<td>Hypocalcemia, hypotension, nausea, vomiting, muscular weakness,</td>
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<tr>
<td>Dextrose 50%</td>
<td>Hypoglycemia, fluid overload, diabetic ketoacidosis,</td>
<td>50-ml syringe slow IV.</td>
<td>Hypoglycemia, fluid overload, diabetic ketoacidosis,</td>
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<td>Dobutamine</td>
<td>Hypertension, Atrial flutter, paroxysmal tachycardia, hypotension, fluid overload,</td>
<td>15-20 mg IV over 2 min.</td>
<td>Hypertension, Atrial flutter, paroxysmal tachycardia, hypotension, fluid overload,</td>
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<td>Diltiazem</td>
<td>Hyperkalemia, hypocalcemia, hypoglycemia, HF, low CO</td>
<td>0.03-0.04 mg/kg</td>
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<tr>
<td>Dopamine</td>
<td>Bradycardia, hypotension</td>
<td>2–10 mcg/min</td>
<td>Sympathomimetic</td>
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<td></td>
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<td>1 mg in 250 mL of NS</td>
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</tr>
<tr>
<td>Epinephrine</td>
<td>Anaphylaxis</td>
<td>1:1000 dil. = 1 mg/mL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cardiac arrest</td>
<td>1:10,000 dil. = 0.1 mg/mL</td>
<td></td>
</tr>
<tr>
<td>Flumazenil</td>
<td>SDT, including AF</td>
<td>First: 0.2 mg IV over 15 sec. Second: 0.3 mg over 30 sec. Third: 0.5 mg over 30 sec.</td>
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<tr>
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<td></td>
<td>&gt;60 kg: 1 mg IVP over 10 min; &lt; 60 kg: 0.01 mg/kg IVP over 10 min.</td>
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<tr>
<td></td>
<td></td>
<td>May repeat every 10 min.</td>
<td></td>
</tr>
<tr>
<td>Isoproterenol</td>
<td>Symptomatic bradycardia</td>
<td>400 mg in 250 mL D5W: cardiac dose: 5–10 mcg/kg/min.</td>
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<tr>
<td></td>
<td></td>
<td>Vasopressor; pre-excitation</td>
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<td></td>
<td>Cardiac arrest</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypotension</td>
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<tr>
<td></td>
<td></td>
<td>Bradycardia</td>
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</tr>
</tbody>
</table>

**WARNING:** DO NOT CONFUSE THE TWO EPINEPHRINE CONCENTRATIONS. The 1:1,000 dilution is equivalent to 0.1 mg/mL and that the 1:10,000 dilution is equivalent to 0.01 mg/mL.

Dilutions: Remember that the 1:1000 dilution is equivalent to 1 mg/mL and that the 1:10000 dilution is 10 times stronger than the 1:1000 dilution.
<table>
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<tr>
<td>Lidocaine</td>
<td>VT, VF, Torsades, low magnesium, Torsades, wide QRS, arrhythmias, tissue necrosis, increased myocardial oxygen demand, hyperkalemia, acidosis</td>
<td>0.5 mg/kg IVP 9–10 min.</td>
<td>Continue to 3 mg/kg IVP.</td>
</tr>
<tr>
<td>Magnesium</td>
<td>VT, VF, Torsades, low magnesium, Torsades, wide QRS, arrhythmias, tissue necrosis, increased myocardial oxygen demand, hyperkalemia, acidosis</td>
<td>0.5–1 mg/kg/min IV infusion</td>
<td>Continue to 2 g in 50 mL D5W over 5–60 min.</td>
</tr>
<tr>
<td>Naloxone</td>
<td>Respiratory depression, short acting, allergic</td>
<td>0.4–2 mg IVP 0.5–1 g/min.</td>
<td>Continue to 20 mg/min IV infusion.</td>
</tr>
<tr>
<td>Norepinephrine</td>
<td>Hypotension, headache</td>
<td>Max: 30 mcg/min.</td>
<td>Continue to 10 mcg/min IV infusion.</td>
</tr>
<tr>
<td>Procainamide</td>
<td>VT, AF</td>
<td>Max: 17 mg/kg.</td>
<td>Continue to 20 mg/min IV infusion.</td>
</tr>
<tr>
<td>Sodium</td>
<td>Hypokalemia, hyponatremia, wide QRS, arrhythmias, tissue necrosis, increased myocardial oxygen demand, hyperkalemia, acidosis</td>
<td>1–2 g in 10 mL D5W or 1–2 mg/h IVF.</td>
<td>Continue to 15 mg/kg IVP.</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>Cardiac arrest, VT, VF</td>
<td>Initial Dose</td>
<td>Drug</td>
</tr>
</tbody>
</table>

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**Considerations:**

- Not recommended for routine use in cardiac arrest.
- Chronic renal failure: Reduced dose in CHF or renal failure patients. Use caution with rapid administration.
- Hypotension: Headache.
- Respiratory depression, short acting, allergic reaction.
- Patients with HF or liver failure: Recommended reduction. Reduce prophylactic use in MI is not indicated.
- Hypokalemia, hyponatremia: Wide QRS, arrhythmias, tissue necrosis, increased myocardial oxygen demand, hyperkalemia, acidosis.
- VT, VF: Cardiac arrest.
Verapamil

<table>
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<td></td>
<td>Cardiac, Hypotension, worsen cardiac wide, complex tachy-</td>
<td>20 mg. in 15-30 min. Max: 2.5-5 mg. IVP over 2 min.</td>
<td>Avoid CHF and LV dysfunction.</td>
</tr>
<tr>
<td></td>
<td>angina, ↓ myocardial ischemia and infarction</td>
<td>Second dose: 5-10 mg IV</td>
<td></td>
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<tr>
<td>Vasopressin</td>
<td>Cardiac arrest, VF</td>
<td>40 units IV/VP x 1 dose.</td>
<td>Initial Dose</td>
</tr>
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*Code cart drugs may vary among facilities, but all contain drugs included in current advanced cardiovascular life support algorithms. Know what drugs are in the code cart at your hospital and in which drawer they are located.

AF = atrial fibrillation; A-flutter = atrial flutter; CHF = congestive heart failure; CO = cardiac output; D5W = dextrose 5% in water; EF = ejection fraction; HF = heart failure; IVP = intravenous push; LV = left ventricle; MI = myocardial infarction; NS = normal saline; PSVT = paroxysmal supraventricular tachycardia; SL = sublingual; ST = ST elevation myocardial infarction; VF = ventricular fibrillation; VT = ventricular tachycardia; WPW = Wolff-Parkinson-White syndrome.
Other Emergency Drugs

**acetylsalicylic acid (Aspirin) (antiplatelet, analgesic)**

**Indications:** acute coronary syndrome, transient ischemic attack (TIA), impending cerebrovascular accident (CVA).

**Dose:** 160–325 mg by mouth (PO) nonenteric-coated for antiplatelet effect.

**Contraindications:** known allergy to aspirin, pregnancy.

**Side Effects:** anorexia, nausea, epigastric pain, anaphylaxis.

**Nursing Considerations:** Use cautiously in presence of active ulcers, asthma, blood dyscrasias.

**activated charcoal (absorbent)**

**Indications:** overdose and poisoning.

**Dose:** 25–100 g PO, nasogastric (NG) tube.

**Contraindications:** concurrent use with syrup of ipecac.

**Side Effects:** constipation, nausea and vomiting (N&V), diarrhea.

**Nursing Considerations:** ineffective in iron overdose.

**albuterol (Ventolin) (bronchodilator)**

**Indications:** reversible airway restriction due to acute bronchospasm, asthma, or chronic obstructive pulmonary disease (COPD).

**Dose:** 1.25–5 mg nebulized in 3 mL saline.

**Contraindications:** hypersensitivity to adrenergic amines.

**Side Effects:** nervousness, restlessness, tremor, tachycardia, anxiety, N&V, diarrhea, headache (HA), hypertension (HTN), hyperglycemia.

**Nursing Considerations:** Use cautiously in tachydysrhythmias, cardiac disease, elderly.

**alteplase (Activase, t-PA) (thrombolytic, fibrinolytic)**

**Indications:** within 4–6 hr of acute MI and 3 hr from onset of symptoms in acute ischemic stroke, pulmonary embolus.

**Dose:** per order.

**Contraindications:** internal bleeding within 10 days, neurovascular event within 2 mo, major surgery or trauma within 2 weeks, aortic dissection, severe (uncontrolled) HTN, bleeding disorder, lumbar puncture within 1 wk.

**Side Effects:** hypotension, reperfusion dysrhythmias, heart failure, HA, increased bleeding time, deep or superficial hemorrhage, flushing, urticaria, anaphylaxis.

**Nursing Considerations:** patients with severe renal or hepatic disease will require lower dose.
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aminophylline (Truphylline) (bronchodilator)
Indications: long-term control of bronchospasm due to asthma or COPD.
Dose: acute severe bronchospasm. Loading dose: 5 mg/kg (ideal body wt) IV. Maintenance dose: 0.5 mg/kg/hr IV. Rate should not exceed 25 mg/min.
Contraindications: uncontrolled dysrhythmias, hyperthyroidism.
Side Effects: seizures, dysrhythmias, anxiety, N&V, tremors.
Nursing Considerations: potentially fatal adverse effects: convulsions, cardiac arrhythmias, hypotension, and sudden death after too rapid IV injection. Monitor results of serum theophylline levels carefully, and arrange for reduced dosage if serum levels exceed therapeutic range of 10–20 mcg/mL. Use cautiously in geriatric patients, patients with CHF or liver failure, obesity. Multiple drug interactions.

angiotensin-converting enzyme (ACE) Inhibitors (captopril, enalapril, lisinopril) (Antihypertensive)
Indications: MI, heart failure without hypotension, ST elevation.
Dose: Individualized.
Contraindications: hypotension, pregnancy, angioedema.
Side Effects: dizziness, headache, fatigue, hypotension, altered LOC.
Nursing Considerations: potentially fatal adverse effect: hyperkalemia, anaphylactic reaction, neutropenia that usually occurs within 3 mo of therapy initiation, especially in patients with renal dysfunction or collagen diseases. Use lower doses in renal failure.

beta blockers (labetalol, metoprolol, propranolol) (antihypertensive)
Indications: MI, unstable angina, PSVT, AF, A-flutter, HTN.
Dose: see individual order and drug for route and dosage.
Contraindications: HR <50, SBP <100, second- or third-degree heart block, left ventricular failure.
Side Effects: hypotension, dizziness, bradycardia, headache, N&V.
Nursing Considerations: concurrent use with calcium channel blockers can cause hypotension; use caution in patients with history of bronchospasm multiple drug interactions.

dexamethasone (Decadron) (glucocorticoid, anti-inflammatory)
Indications: anaphylaxis, cerebral edema, spinal trauma, shock.
Dose: 10 mg IVP.
Contraindications: ulcer, infection, alcohol intolerance.
Side Effects: peptic ulceration, HTN, N&V.
Nursing Considerations: tissue necrosis can occur if IV infiltrates.
digoxin (Lanoxin) (inotropic, antidysrhythmic)
**Indications:** atrial fibrillation and atrial flutter, CHF, pulmonary edema.
   May be used as an alternative treatment for PSVT.
**Dose:** Loading dose of 10–15 mcg/kg.
**Contraindications:** uncontrolled atrial dysrhythmias, AV block, idiopathic hypertrophic subaortic stenosis (IHSS), constrictive pericarditis.
**Side Effects:** dysrhythmias, particularly VF, AV block, atrial fibrillation, fatigue, bradycardia, N&V, blurred or yellow vision, HA, hypersensitivity, hypokalemia.
**Nursing Considerations:** Monitor drug levels carefully, especially in presence of hypokalemia.

digoxin immune fab (Digibind) (antidote to Digoxin, Digitoxin)
**Indications:** symptomatic digoxin toxicity or acute ingestion of unknown amount of digoxin.
**Dose:** dependent on serum digoxin levels. One 40-mg vial binds to approximately 0.6 mg of digoxin.
**Contraindications:** allergy only; otherwise, none known.
**Side Effects:** worsening of CHF, atrial fibrillation, hypokalemia, increased serum digoxin levels.
**Nursing Considerations:** digitalis toxicity can cause hyperkalemia; however, potassium levels may drop rapidly after Digibind administration. Monitor levels frequently, especially in first several hours. Use reconstituted Digibind promptly or refrigerate up to 4 hr.

diphenhydramine (Benadryl) (antihistamine)
**Indications:** anaphylactic reaction, extrapyramidal symptoms.
**Dose:** 10–50 mg IV or deep IM; not to exceed 400 mg/24 hr.
**Contraindications:** asthma, pregnancy, lactation.
**Side Effects:** dry mouth, drowsiness, hypotension.
**Nursing Considerations:** use with caution in elderly, severe liver disease, narrow-angle glaucoma, pregnancy.

furosemide (Lasix) (diuretic)
**Indications:** CHF with acute pulmonary edema, hypertensive crisis, increased intracranial pressure (ICP), nephrotic syndrome, hepatic cirrhosis.
**Dose:** 0.5–1 mg/kg slow IVP over 1–2 min, may repeat once at 2 mg/kg slow IVP over 1–2 min.
**Contraindications:** anuria, hypotension, hepatic coma, dehydration, hypokalemia, hypersensitivity to sulfonamides.
**Side Effects:** severe dehydration/hypovolemia, hypotension, hypokalemia, hyponatremia, hypochloremia, azotemia, vertigo, dizziness.
Nursing Considerations: monitor urine output and electrolytes during therapy; assess injection site for phlebitis.

glycoprotein IIb and IIIa inhibitors (abciximab, eptifibatide, tirofiban) (platelet aggregation inhibitor)
Indications: acute coronary syndrome without ST-segment elevation, adjunct to percutaneous coronary intervention in patients with high risk of abrupt closure of treated coronary vessel.
Dose: see individual order and drug for route and dosages.
Contraindications: active internal bleeding within 30 days, history of neurovascular event or head trauma within previous month, within 2 yr of neurosurgery, aortic dissection, severe (uncontrolled) HTN, within 6 weeks of a known gastrointestinal (GI) or genitourinary (GU) bleed, known bleeding disorder.
Side Effects: increased bleeding and bruising, GI irritation.
Nursing Considerations: increased risk of bleeding; use with caution in elderly, patients with history of GI bleeding, or those receiving anticoagulants; multiple herbal interactions.

glucagon (pancreatic hormone)
Indications: severe hypoglycemia; used to decrease GI motility during GI procedures.
Dose: antidote to calcium channel blocker: 2 mg IV; antidote to beta blocker: 50–150 mcg/kg IVP followed by a 1–5 mg/hr infusion; hypoglycemia: 0.5–1 mg IV, IM, subcutaneous; to decrease GI motility: 0.25–1 mg slow IVP or up to 2 mg IM.
Contraindications: known allergy to beef or pork protein.
Side Effects: N&V.
Nursing Considerations: depletes glycogen stores; give complex carbohydrates as soon as patient can take solids.

heparin (anticoagulant)
Indications: acute pulmonary/peripheral embolism, atrial fibrillation with embolization, treatment of DIC.
Dose: per order.
Contraindications: active bleeding, blood dyscrasias, thrombocytopenia, liver disease, suspected intracranial hemorrhage, ulceration of the GI tract, subendocarditis, shock, threatened abortion, severe HTN, hypersensitivity.
Side Effects: minor to major hemorrhage, thrombocytopenia, anaphylaxis.
Nursing Considerations: use with caution after CVA, recent internal or intracranial bleeding, coagulopathies, and in the elderly; multiple herbal interactions.
hydrocortisone (A-hydroCort, Solu-Cortef) (corticosteroid)
Dose: individualized.
Indications: shock secondary to adrenocortical insufficiency or shock unresponsive to conventional therapy when adrenocortical insufficiency may be present, multiple systemic disorders.
Side Effects: fluid and electrolyte disturbances; decreased carbohydrate tolerance; impaired wound healing; thin, fragile skin; muscle weakness; steroid myopathy; osteoporosis; aseptic necrosis; peptic ulceration with possible perforation; cataracts; increased intraocular and intracranial pressure; growth retardation; Cushingoid state; protein catabolism; psychic derangements; exophthalmos; masking of infections; gasping syndrome; seizures; menstrual irregularities.
Nursing Considerations: monitor patient for signs of infection (fever, elevated white blood cell count) and adrenal crisis (headache, vomiting, fever, abdominal pain, hypotension).

inamrinone (Inocor) (inotropic)
Indications: short-term treatment of CHF.
Dose: individualized.
Contraindications: hypersensitivity to bisulfates, idiopathic hypertrophic subaortic stenosis.
Side Effects: dyspnea, dysrhythmias, hypotension, N&V, diarrhea, hepatoxicity, hypersensitivity, tachyphylaxis.
Nursing Considerations: can increase myocardial ischemia; monitor cardiac rhythm, BP, heart rate. Dilute only with saline preparations (normal or half normal saline), no dextrose. Do not administer furosemide in same IV line as inamrinone.

lorazepam (Ativan) (anticonvulsant, anxiolytic, sedative, hypnotic)
Indications: status epilepticus, acute alcohol withdrawal.
Dose: 0.05 mg/kg, maximum 4 mg each dose; may be repeated after 10–15 min, not to exceed 8 mg/12 hr or 2 mg/min IV infusion.
Contraindications: allergy to benzodiazepines, narrow-angle glaucoma.
Side Effects: dizziness, drowsiness, lethargy, apnea, cardiac arrest, paradoxical excitation, N&V, diarrhea.
Nursing Considerations: risk of toxicity increased with severe hepatic, renal, pulmonary impairment.

mannitol (Osmitrol) (osmotic diuretic)
Indications: increased ICP, the oliguric phase of acute renal failure, severe intraocular pressure, diuresis of toxic substances.
Dose: 1.5–2 g/kg IV over 30–60 min.
**Contraindications:** intracranial bleeding, pulmonary edema, anuria, dehydration.

**Side Effects:** altered LOC, HA, blurred vision, N&V, tachycardia, hypotension or HTN, chest pain, CHF, seizures.

**Nursing Considerations:** monitor electrolytes, urine output, and fluid balance; observe for cardiopulmonary complications.

**metaproterenol (Alupent) (adrenergic agonist [bronchodilator])**

**Indications:** reversible airway restriction due to asthma or chronic obstructive pulmonary disease (COPD).

**Dose:** 10–15 mg nebulized in 3 mL saline.

**Contraindications:** hypersensitivity.

**Side Effects:** nervousness, restlessness, tremor, tachycardia, anxiety, N&V, diarrhea, HA, HTN, hyperglycemia.

**Nursing Considerations:** observe for paradoxical bronchospasm, adverse cardiovascular effects.

**milrinone (Primacor) (inotropic)**

**Indications:** short-term treatment of CHF in patients receiving digoxin and diuretics.

**Dose:** individualized.

**Contraindications:** obstructive pulmonic or aortic valvular disease, hypersensitivity.

**Side Effects:** VT, SVT, hypotension, abnormal digoxin levels, angina, HA, hypokalemia, tremors.

**Nursing Considerations:** use cautiously in patients with history of dysrhythmias, electrolyte imbalances, renal impairment, pregnancy.

**morphine sulfate (opioid analgesic)**

**Indications:** moderate to severe pain, chest pain unrelieved with nitroglycerine (NTG), CHF and dyspnea associated with pulmonary edema.

**Dose:** 4–15 mg IVP q 3–4 hr or as a loading dose titrated to respiratory status followed by an infusion of 0.2–1 mg/mL.

**Contraindications:** heart failure due to chronic lung disease, respiratory depression, hypotension, undiagnosed acute abdominal pain, head injury, altered LOC, acute alcoholism, delirium tremens.

**Side Effects:** respiratory depression, hypotension, N&V, bradycardia, altered LOC, seizures.

**Nursing Considerations:** reverse with Narcan, multiple drug interactions.

**nicardipine (Cardepine) (calcium antagonists)**

**Indications:** hypertensive emergencies or urgencies, perioperative and postoperative HTN, hypertensive states of nothing by mouth (NPO) patients.
**Dose:** IV infusion. Dilute to 10–20 mg/100 mL (1.01%–0.02%). Initial infusion rate: 5 mg/hr; titrate dose up to 15 mg/hr until desired therapeutic response is achieved (diastolic BP <95 mm Hg, systolic BP <140 mm Hg). Maintenance rate: Can be tapered down to ≤10 mg/hr. IV bolus 2–7 mg without dilution given over 1–2 min.

**Side Effects:** peripheral edema, headache, tachycardia, palpitations, localized thrombophlebitis and hypotension.

**Nursing Considerations:** patients with hepatic impairment should receive lower dose. Monitor BP. Allow at least 3 days between dosage adjustment to achieve steady plasma levels. Advise patient to report immediately if experiencing chest pain.

**nitroprusside (Nipride, Nitropress) (vasodilator)**  
**Indications:** hypertensive crisis, acute CHF.  
**Dose:** per order.  
**Contraindications:** aortic coarctation or AV shunting, high-output failure in endotoxic sepsis.  
**Side Effects:** dizziness, restlessness, nausea, HA, palpitations, bradycardia, tachycardia, flushing, seizures, increased ICP, thiocyanate toxicity.  
**Nursing Considerations:** use with caution in hypothyroidism, liver or renal impairment, increased ICP, and the elderly.

**phenytoin (Dilantin) (antiseizure)**  
**Indications:** tonic-clonic and complex partial (psychomotor, temporal lobe), prevention and treatment of seizures occurring during or after neurosurgery.  
**Dose:** adult: initially 100 mg three times daily (tid). Maintenance: 300–400 mg daily. Children ≥6 yr: initially 100 mg tid, adjust subsequent dosage according to therapeutic response; <6 yr: 30 mg twice daily (bid), may be increased to 30 mg tid or four times daily (qid).  
**Action:** may stabilize neuronal membranes and limit seizure activity either by increasing efflux or decreasing influx of sodium ions across cell membrane in the motor cortex during generation of nerve impulses.  
**Side Effects:** GI disturbances; ataxia, slurred speech; diplopia, nystagmus and mental confusion w/headache, dizziness, gingival hyperplasia, hirsutism, hyperglycemia, osteomalacia.  
**Nursing Considerations:** assess location, duration, frequency, and characteristics of seizure activity. Electroencephalogram may be monitored periodically throughout therapy, assess oral hygiene. Vigorous oral cleaning beginning within 10 days of initiation of phenytoin therapy may help control gingival hyperplasia.
Always consult an authoritative, current reference about dose, dilution, interactions, and route and rate of administration before administering medications, especially IV medications. For high-alert medications (see next), have a second licensed person independently check dose calculations, preparation, original orders, and infusion pump programming.

**High-Alert Medications**

- **High-alert medications**: drugs that have a high risk of causing injury or death when improperly handled or administered.
- The high-alert medications most often prescribed:
  - Insulin.
  - Opiates and narcotics.
  - Injectable potassium chloride (or phosphate) concentrate.
  - IV anticoagulants (heparin).
  - Sodium chloride solutions >0.9%.
- Exercise extreme caution when administering these medications:
  - Adrenergic agonists, IV (e.g., epinephrine, isoproterenol, norepinephrine).
  - Cardioplegic solutions.
  - Chemotherapeutic agents.
  - Chloral hydrate (in pediatric patients).
  - Colchicine injection.
  - High-concentration dextrose (>10% dextrose).
  - Hypoglycemic agents (oral).
  - Hypertonic sodium chloride injection (>0.9% concentration).
  - Inotropic agents, IV (digoxin, milrinone).
  - Insulin.
  - IV adrenergic antagonists (propranolol, esmolol, metoprolol).
  - IV calcium.
  - IV magnesium sulfate.
  - IV potassium (phosphate and chloride).
  - Midazolam and other sedation agents.
  - Neuromuscular blocking agents.
  - Opiates (opioids).
  - Thrombolytics, heparin, warfarin.
Confusing Abbreviations and Symbols

Certain abbreviations and symbols have been associated with repeated medication errors. Clarify any medication order containing these error-prone shortcuts.

### Error-Prone Abbreviations and Symbols

<table>
<thead>
<tr>
<th>Drug Names</th>
<th>Symbols</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARAA</td>
<td>(dram)</td>
<td>mcg</td>
</tr>
<tr>
<td>AZT</td>
<td>µ (minim)</td>
<td>AD, AS, AU</td>
</tr>
<tr>
<td>CPZ</td>
<td>@ (at)</td>
<td>OD, OS, OU</td>
</tr>
<tr>
<td>DTO</td>
<td>&amp; (and)</td>
<td>BT</td>
</tr>
<tr>
<td>DTO</td>
<td>/ (slash)</td>
<td>cc</td>
</tr>
<tr>
<td>HCl</td>
<td>+ (plus)</td>
<td>D/C</td>
</tr>
<tr>
<td>HCT</td>
<td>– (minus)</td>
<td>IJ</td>
</tr>
<tr>
<td>HCTZ</td>
<td>&gt; (greater than)</td>
<td>IN</td>
</tr>
<tr>
<td>IV Vanc</td>
<td>&lt; (less than)</td>
<td>HS, hs</td>
</tr>
<tr>
<td>MgSO4</td>
<td>Apothecary symbols</td>
<td>IU</td>
</tr>
<tr>
<td>MTX</td>
<td></td>
<td>o.d., OD</td>
</tr>
<tr>
<td>Nitro drip</td>
<td></td>
<td>OJ</td>
</tr>
<tr>
<td>Norflox</td>
<td></td>
<td>per os</td>
</tr>
<tr>
<td>PCA</td>
<td></td>
<td>q.d., QD</td>
</tr>
<tr>
<td>PTU</td>
<td></td>
<td>q1d</td>
</tr>
<tr>
<td>T3</td>
<td></td>
<td>q6PM, etc.</td>
</tr>
<tr>
<td>TAC</td>
<td></td>
<td>SSRI, SSI</td>
</tr>
<tr>
<td>TNK</td>
<td></td>
<td>1/d</td>
</tr>
<tr>
<td>TNK</td>
<td></td>
<td>TIW, tiw</td>
</tr>
<tr>
<td>ZnSO4</td>
<td></td>
<td>U, u</td>
</tr>
</tbody>
</table>

General Tips

- Do not use zeroes after a decimal point.
- Always use a zero before a decimal point.
- Use commas for dosing units at or above 1,000.
- Place adequate space between a drug name, dose, and the unit of measure.
Safe Medication Administration

- Carefully read product packaging to note strength of solution, dosage, and/or route of administration.
- Double-check with a pharmacist about dose range.
- Have a colleague double-check dosage calculations and infusion pump programming.
- Use the Five Rights (right drug, right dose, right patient, right route, and right time) as a guide.
- Clarify any order that is incomplete, contains abbreviations, is confusing or hard to read, or raises a question.
- Suspect a missed decimal point, and clarify any order if the dose requires more than 3 dosing units.
- If taking a verbal order, ask prescriber to spell out the drug name and dosage to avoid sound-alike confusion (e.g., hearing Cerebyx for Celebrex or fifty for fifteen).
- Read back the order to the prescriber after you have written it in the chart.
- Do not borrow medications from other patients or begin new medications before the order has been received in the pharmacy; to do so circumvents the built-in checks that can detect a prescribing error.
- Review each patient’s medications for:
  - Medication use without an indication.
  - Contraindications.
  - Improper drug selection.
  - Overdose/subtherapeutic dose (consider age, renal/hepatic impairment).
  - Medication duplication.
  - Efficacy.
  - Adverse drug reactions/toxicity.
  - Potential drug or food interactions.
  - Weight changes requiring dosage adjustments.
  - Appropriate duration of therapy.
  - Adherence with prescribed medication therapy.

Patient Education and Medication Use

Educating patients about their medications is a critical nursing function that promotes proper medication use and improved outcomes. It also can
prevent adverse drug reactions or early or improper discontinuation of a medication. Many issues related to medication errors, such as ambiguous directions, unfamiliarity with a drug, and confusing packaging, affect the patient as well as the health care providers, emphasizing the need for careful education. Patient education also enhances compliance, which is a factor in proper medication use.

- All patients need clear written and verbal instruction for all medications.
- Present information in a format the patient can understand.
- Use an interpreter if provider and patient speak different languages.
- Do not rush.
- Include family members.
- Have the patient repeat the information you provide.
- Make sure to tell the patient:
  - The brand and generic names of the medication.
  - The purpose of the medication.
  - The strength and dose and when to take the medication.
  - Possible side effects and what to do if they occur.
  - How long to take the medication.
  - What medications or foods to avoid and why they should be avoided.
  - How to store the medication.
  - What to do if a dose is missed.
  - What activities, if any, should be avoided while on the medication.
  - Signs and symptoms of adverse drug reactions.

### IV Rates and Compatibilities

#### IV Fluid Drip Rate Table (drops/min)

<table>
<thead>
<tr>
<th>Rate: mL/hr</th>
<th>TKO</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 gtt/mL set</td>
<td>5</td>
<td>8</td>
<td>13</td>
<td>17</td>
<td>21</td>
<td>25</td>
<td>29</td>
<td>33</td>
<td>42</td>
</tr>
<tr>
<td>12 gtt/mL set</td>
<td>6</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>15 gtt/mL set</td>
<td>8</td>
<td>13</td>
<td>19</td>
<td>25</td>
<td>31</td>
<td>37</td>
<td>44</td>
<td>50</td>
<td>62</td>
</tr>
<tr>
<td>20 gtt/mL set</td>
<td>10</td>
<td>17</td>
<td>25</td>
<td>33</td>
<td>42</td>
<td>50</td>
<td>58</td>
<td>67</td>
<td>83</td>
</tr>
<tr>
<td>60 gtt/mL set</td>
<td>30</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>125</td>
<td>150</td>
<td>175</td>
<td>200</td>
<td>250</td>
</tr>
</tbody>
</table>

Note: TKO (to keep open) is 30 mL/hr.
Medications Compatible with IV Potassium Chloride (KCl)

- acyclovir
- alatrofloxacin
- aldesleukin
- allopurinol
- amifostine
- aminophylline
- amiodarone
- ampicillin
- amrinone
- atropine
- aztreonam
- betamethasone
- calcium gluconate
- chlordiazepoxide
- chlorpromazine
- cimetidine
- ciprofloxacin
- cisatracurium
- cladribine
- cyanocobalamin
- dexamethasone
- digoxin
- diltiazem
- diphenhydramine
- dobutamine
- docetaxel
- dopamine
- doxorubicin liposome
- droperidol
- droperidol/fentanyl
- edrophonium
- enalaprilat
- epinephrine
- esmolol
- conjugated estrogens
- ethacrylate sodium
- etoposide
- famotidine
- fentanyl
- filgrastim
- fludarabine
- fluorouracil
- furosemide
- gatifloxacin
- gemcitabine
- granisetron
- heparin
- hydralazine
- idarubicin potassium
- indomethacin
- insulin
- isoproterenol
- kanamycin
- labetalol
- lidocaine
- linezolid
- lorazepam
- magnesium sulfate
- melphalan
- menadiol
- meperidine
- methoxamine
- methylergonovine
- midazolam
- minocycline
- morphine
- neostigmine
- norepinephrine
- ondansetron
- oxacillin
- oxytocin
- paclitaxel
- penicillin G potassium
- pentazocine
- phytonadione
- piperacillin/tazobactam
Medications Incompatible with IV KCl

- adrenaline HCl
- amphotericin B cholesteryl sulfate complex
- atropine sulfate
- cephalothin sodium
- chloramphenicol sodium succinate
- chlorpromazine HCl
- diazepam
- ergotamine tartrate
- methicillin sodium
- phenytoin
- phenytoin sodium
- sulphadiazine sodium
- suxamethonium chloride
- thiopentone sodium

Reference Ranges for Common Laboratory Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Conventional</th>
<th>SI Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
<td>3.9–5.0 g/dL</td>
<td>35–50 g/L</td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
<td>44–147 units/L</td>
<td>40–120 U/L</td>
</tr>
<tr>
<td>Alanine transaminase (ALT)</td>
<td>6–59 units/L</td>
<td>20–65 U/L</td>
</tr>
</tbody>
</table>

Continued
## Chemistries—cont’d

<table>
<thead>
<tr>
<th>Test</th>
<th>Conventional</th>
<th>SI Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspartate transaminase (AST)</td>
<td>10–34 units/L</td>
<td>15–45 U/L</td>
</tr>
<tr>
<td>Blood urea nitrogen (BUN)</td>
<td>7–20 mg/dL</td>
<td>2.9–8.9 mmol/L</td>
</tr>
<tr>
<td>Bilirubin, direct</td>
<td>0.0–0.3 mg/dL</td>
<td>0–8 µmol/L</td>
</tr>
<tr>
<td>Bilirubin, total</td>
<td>0.2–1.9 mg/dL</td>
<td>0–20 µmol/L</td>
</tr>
<tr>
<td>Calcium</td>
<td>8.5–10.9 mg/dL</td>
<td>2.15–2.5 mmol/L</td>
</tr>
<tr>
<td>Chloride</td>
<td>101–111 mmol/L</td>
<td>98–106 mmol/L</td>
</tr>
<tr>
<td>Cholesterol, total</td>
<td>100–240 mg/dL</td>
<td>2–5.19 mmol/L</td>
</tr>
<tr>
<td>CO₂</td>
<td>20–29 mEq/L</td>
<td>20–29 mmol/L</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.8–1.4 mg/dL</td>
<td>70–120 µmol/L</td>
</tr>
<tr>
<td>Gamma-GT</td>
<td>0–51 units/L</td>
<td>10–58 U/L</td>
</tr>
<tr>
<td>Glucose</td>
<td>64–128 mg/dL</td>
<td>3.3–11 mmol/L</td>
</tr>
<tr>
<td>Lactate dehydrogenase (LDH)</td>
<td>105–333 units/L</td>
<td>300–600 mmol/L</td>
</tr>
<tr>
<td>Lactic acid</td>
<td>0.5–1.5 mEq/L or 8.1–15.3 mg/dL</td>
<td>SI units: 0.5–1.5 mmol/L</td>
</tr>
<tr>
<td>Magnesium</td>
<td>1.5–2 mEq/L</td>
<td>0.7–1.05 mmol/L</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>2.4–4.1 mg/dL</td>
<td>0.8–1.4 mmol/L</td>
</tr>
<tr>
<td>Potassium</td>
<td>3.5–5 mEq/L</td>
<td>3.5–5 mmol/L</td>
</tr>
<tr>
<td>Protein, total</td>
<td>6.3–7.9 g/dL</td>
<td>60–80 g/L</td>
</tr>
<tr>
<td>Sodium</td>
<td>136–144 mEq/L</td>
<td>136–144 mmol/L</td>
</tr>
<tr>
<td>Uric acid, serum</td>
<td>Male: 4.0–8.5 mg/dL; Female: 2.8–7.3 mg/dL</td>
<td>Male: 0.24–0.51 mmol/L; Female: 0.16–0.43 mmol/L</td>
</tr>
</tbody>
</table>

Note: SI units areSI units in parentheses.
### Coagulation Profile

<table>
<thead>
<tr>
<th>Test</th>
<th>Conventional</th>
<th>SI Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>International normalize ratio (INR)</td>
<td>0.9–1.2</td>
<td>0.9–1.2</td>
</tr>
<tr>
<td>Prothrombin time (PT)</td>
<td>10–14 sec</td>
<td>10–14 sec</td>
</tr>
<tr>
<td>Partial thromboplastin time (PTT)/activated PTT (aPTT)</td>
<td>21–37 sec</td>
<td>21–37 sec</td>
</tr>
<tr>
<td>D-dimer</td>
<td>&lt;0.5 mcg/mL</td>
<td></td>
</tr>
<tr>
<td>Fibrin degradation products (FDP)</td>
<td>&lt;5 mcg/mL</td>
<td></td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>150–400 mg/dL</td>
<td>1.7–4.1 g/L</td>
</tr>
</tbody>
</table>

### Cardiac Markers

<table>
<thead>
<tr>
<th>Test</th>
<th>Conventional</th>
<th>SI Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin cobalt binding test</td>
<td>&lt;85 U/mL</td>
<td>&lt;85 U/mL</td>
</tr>
<tr>
<td>B-type natriuretic peptide</td>
<td>0–100 pg/mL</td>
<td>Ø–100 ng/L</td>
</tr>
<tr>
<td>Creatinine phosphokinase, creatine kinase</td>
<td>Male: 55–170 U/L</td>
<td>Male: 55–170 U/L</td>
</tr>
<tr>
<td></td>
<td>Female: 30–135 U/L</td>
<td>Female: 30–135 U/L</td>
</tr>
<tr>
<td>CK isoenzymes</td>
<td>CK-MB: 0%–3%</td>
<td>0–0.03</td>
</tr>
<tr>
<td>Troponins (TnI, TnT)</td>
<td>Cardiac troponin T:</td>
<td>Cardiac troponin T:</td>
</tr>
<tr>
<td></td>
<td>&lt;0.2 ng/mL</td>
<td>&lt;0.2 ng/mL</td>
</tr>
<tr>
<td></td>
<td>&lt;0.03 ng/mL</td>
<td>&lt;0.03 ng/mL</td>
</tr>
<tr>
<td>Myoglobin, serum</td>
<td>&lt;90 mcg/L</td>
<td>&lt;90 mcg/L</td>
</tr>
<tr>
<td>Lactate dehydrogenase (LD, LDH), LDH isoenzymes</td>
<td>100–190 U/L</td>
<td>100–190 U/L</td>
</tr>
<tr>
<td>Aspartate aminotransferase</td>
<td>0–35 U/L</td>
<td>0–0.58 µkat/L</td>
</tr>
</tbody>
</table>
## Hematology

<table>
<thead>
<tr>
<th>Test</th>
<th>Conventional</th>
<th>SI Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red blood cell (RBC)</td>
<td>Male: 4.6–6.2 million/ mm³ Female: 4.2–5.9 million/ mm³</td>
<td>4.6–6.2 × 10¹²/L Female: 4.2–5.9 × 10¹²/L</td>
</tr>
<tr>
<td>Hemoglobin (Hgb)</td>
<td>Male: 13–18 g/100 mL Female: 12–16 g/100 mL</td>
<td>8.1–11.2 mmol/L    Female: 7.4–9.9 mmol/L</td>
</tr>
<tr>
<td>Hematocrit (Hct)</td>
<td>Male: 45%–52% Female: 37%–48%</td>
<td>0.45–0.52          Female: 0.37–0.48</td>
</tr>
<tr>
<td>Leukocytes (WBC)</td>
<td>4,300–10,800/mm³</td>
<td>4.3–10.8 × 10⁹/L</td>
</tr>
<tr>
<td>Bands</td>
<td>0%–5%</td>
<td>0.03–0.08</td>
</tr>
<tr>
<td>Basophils</td>
<td>0%–1%</td>
<td>0–0.01</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>1%–4%</td>
<td>0.01–0.04</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>25%–40%</td>
<td>0.25–0.40</td>
</tr>
<tr>
<td>B lymphocytes</td>
<td>10%–20%</td>
<td>0.10–0.20</td>
</tr>
<tr>
<td>T lymphocytes</td>
<td>60%–80%</td>
<td>0.60–0.80</td>
</tr>
<tr>
<td>Monocytes</td>
<td>2%–8%</td>
<td>0.02–0.08</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>54%–75%</td>
<td>0.54–0.75</td>
</tr>
<tr>
<td>Erythrocyte sedimentation</td>
<td>Male: 1–13 mm/hr Female: 1–20 mm/hr</td>
<td>1–20 mm/hr</td>
</tr>
<tr>
<td>rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Platelets</td>
<td>150,000–450,000 mm³</td>
<td>150–450 × 10⁹/L</td>
</tr>
<tr>
<td>Sedimentation rate</td>
<td>Males under 50 yr: &lt;15 mm/hr Male: 50 yr: &lt;20 mm/hr Female under 50 yr: &lt;20 mm/hr Females over 50 yr: &lt;30 mm/hr (Westergren method)</td>
<td></td>
</tr>
</tbody>
</table>
The goal of postoperative care is to prevent complications, keep the patient comfortable and safe, promote healing, and educate the patient/family how to continue care after discharge. Postoperative care depends on the individual’s baseline health status as well as the type of surgery.

Thorough, frequent assessments are critical to detecting potentially life-threatening complications in the immediate postoperative period. Always time date your assessments and notify the surgeon and/or your unit director promptly of findings that concern you.

Receiving the Patient from the Postanesthesia Care Unit

You may receive report over the phone from the postanesthesia care staff or on your unit. Either way, meet them in the room to receive any additional information, ask questions, and assess the patient.

Review vital signs taken in the PACU (postanesthesia care unit) and obtain blood pressure (BP), pulse, respiratory rate, and O₂ saturation. Evaluate whether your readings are consistent with measurements taken in the PACU.

Be sure to note whether breathing is regular and without effort or noises. If the patient is on a continuous infusion of opioids, check frequently for respiratory depression and hypoventilation.

Note if dressing is in good condition and if any drainage is within expected limits.

Determine that IV is infusing properly, drains have been emptied, and urinary catheter bag emptied.

Ask the patient about pain; note time of last pain medication administered and the route of administration. Intravenous (IV) medications have much shorter duration of action.

Carefully transfer the patient to the bed, paying close attention to IV lines and drains. Make sure patient splints an abdominal or thoracic incision or operative extremity is supported.

Ask PACU nurse about patient’s preoperative or baseline cognitive status. If the patient is not fully oriented, it is best to understand the exact nature of the confusion. Have a family member present if possible.

Check chart for specific positioning orders. Remember, if the patient has had spinal anesthesia, he or she may be required to lay flat for several hours.

If patient is not fully conscious, place him or her in a side-lying position (if feasible) to prevent aspiration of vomitus.
Raise side rails.

- Assess patient’s level of consciousness (LOC). The patient may be quite drowsy but should awaken fully to verbal stimuli.
- Check wound dressings for characteristics and amount of drainage. Circle and time drainage so that you can determine rate of drainage over time. If there is a large amount of drainage on the dressings, document it and call the surgical staff immediately.
- See that dressings are intact and that any drains are secure.
- If the operative site is an extremity, assess movement, circulation, and sensation of fingers or toes. If dressings are bulky, you may be able to assess only capillary refill time and sensation. Usually the patient will be able to move the fingers or toes to some degree even when dressings obscure most of the area.
- Check IV site and fluids. Note amount and type of solution. Check chart for rate at which the IV fluids should be infusing, and correct drip rate if necessary. Have next IV fluid on hand.
- Assess other drains, such as an indwelling urinary catheter or nasogastric tube (NGT). Make sure drainage bags or containers are set up properly so that they will drain. Make sure suction setups are functioning.
- Check whether O₂ has been ordered and that it is set up properly and at the correct flow rate.
- Note the color, temperature, and moistness of the patient’s skin. The skin should be warm and dry. Red flags are pale or ashen coloring, coldness, and perspiration. **QI** Immediately recheck BP and heart rate (HR) if your patient exhibits these signs of shock.
- Ask the patient about incisional pain, nausea, or positional discomfort. If the patient has pain, note the location and intensity. Use a verbal or visual scale. Also ask how distressed the patient is by the level of pain and if he or she wants pain medication. Determine what analgesic was given last and when. Ask patient if it was effective. Medicate patient per the orders and evaluate effectiveness in the appropriate time frame. (See Pain tab for more information.)
- Address any positional discomfort, and make sure the patient is warm enough.
- Recheck vital signs at the frequency ordered and more frequently if there are significant changes (see Shock in Emergency tab and Early Warning grid in Tools tab).
- When you recheck vital signs, recheck the dressings, drains, IVs, and other equipment. Note the patient’s LOC and ask questions about nausea, need to urinate (if no indwelling catheter), general comfort level, and others depending on the surgery and circumstances.
After the Immediate Postoperative Period

■ Once the patient’s condition is stable and he or she has recovered from anesthesia, anywhere from 2 to several hours depending on procedure, frequency of nursing assessment may be every 4 to 8 hours.

■ Assessments continue to be specific to the surgery as well as a general review of systems.

■ In addition, the focus expands to recovering from the surgery itself and preventing later complications.

■ Specific interventions for recovery from the surgery vary, but generally it involves increasing activity tolerance, managing pain, resuming activities of daily living, eating, ambulating, etc.

■ Preventing complications, whether they are in the immediate postoperative period or in the days after surgery is a critical component of care.

### Potential Complications of Anesthesia

<table>
<thead>
<tr>
<th>Effect</th>
<th>Potential Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignant hyperthermia</td>
<td>Death</td>
</tr>
<tr>
<td>Confusion</td>
<td>Patient injury</td>
</tr>
<tr>
<td>↓ Respiratory rate and depth</td>
<td>Atelectasis, pneumonia</td>
</tr>
<tr>
<td>Diminished gag reflex</td>
<td>Aspiration</td>
</tr>
<tr>
<td>↓ BP Shock Mild hypotension: 10%–15% drop</td>
<td>Shock</td>
</tr>
<tr>
<td>Significant hypotension: 20%–30% drop</td>
<td></td>
</tr>
<tr>
<td>↑ BP</td>
<td>MI, dysrhythmias, pulmonary edema, left ventricular failure, cerebral hemorrhage</td>
</tr>
<tr>
<td>↓ Peristalsis</td>
<td>Ileus, obstruction, nausea and vomiting</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>Volume deficit, electrolyte imbalance</td>
</tr>
<tr>
<td>Urinary retention</td>
<td>UTI, bladder overdistention</td>
</tr>
</tbody>
</table>
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Potential Postoperative Complications

Fever

Fever after surgery is common. The significance of the fever depends on how high the temperature is and when it develops.

### Postoperative Fevers

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Temperature</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 48 hr postop</td>
<td>&lt;100.4°F (38°C)</td>
<td>Tissue damage at operative site. Hematoma.</td>
</tr>
<tr>
<td></td>
<td>&gt;100.4°F (38°C)</td>
<td>Atelectasis with infection. Infectious related to surgery, e.g., urinary tract infection (UTI) after urological surgery. Blood transfusion or drug reaction.</td>
</tr>
<tr>
<td>Days 3–5</td>
<td>Low grade or higher</td>
<td>Bronchial pneumonia. Sepsis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wound infection. IV site infection or phlebitis. Abscess formation depending on the surgery. Deep vein thrombosis (DVT).</td>
</tr>
<tr>
<td>After 5 days</td>
<td>Low grade or higher</td>
<td>Complications related to surgery.</td>
</tr>
<tr>
<td>After 1 week</td>
<td>Low grade or higher</td>
<td>Wound infection. Distant sites of infection, e.g., UTI. DVT, pulmonary embolus.</td>
</tr>
</tbody>
</table>
Interventions

- Encourage coughing and deep breathing (C&DB) exercises and use of incentive spirometer.
- Auscultate lung sounds before and after exercises. In atelectasis, breath sounds will be diminished at the bases, possibly with fine crackles. Breath sounds should be louder, and crackles should clear after breathing exercises.
- Follow activity orders and have patient get up and walk to the extent recommended and without overly tiring the patient.
- Assess for DVT; make sure support stocking or compression devices are on properly.
- Assess wound for purulent drainage, gaping of wound edges, and excessive pain and tenderness.
- Assess temperature every 4 hr; do not medicate with acetaminophen unless the patient is uncomfortable from the fever; fever is a necessary part of the immune response to infection.
- Assess for signs and symptoms of UTI (burning with urination, flank pain, frequency). Palpate bladder after voiding to assess for postvoid residual.

Wound Infection

Postoperative wound infection is a serious complication that prolongs hospital length of stay and raises costs (see Surgical Site Infection/Complication for signs and symptoms, immediate interventions, focused assessment, etc.).

- The most common infection occurring after surgery is a superficial wound infection.
  - Occurs usually within the first week.
  - Presents as localized pain and redness with minimal discharge.
  - May be treated simply with wet to dry dressing changes. Use aseptic technique and wash hands thoroughly before and after dressing change.
- Less common is a peri-incisional cellulitis or deep tissue abscess.
  - Occurs most often after bowel surgery.
  - Usually presents within first postoperative week.
  - Cellulitis is treated with antibiotics.
  - Abscess requires antibiotics, removal of sutures, and probing of the wound.
  - Wound will most likely require a wound vacuum, or packing and frequent dressing changes depending on amount of drainage.
Deep abscesses may need to be reexplored in the operating room.

Wound will be left open to heal by secondary intention.

Gas gangrene is rare but life threatening.

It presents as a rapidly swelling, painful wound with brownish or bloody discharge. The skin around the incision makes a crackling sound when palpated (crepitus). This crackling results from air trapped in the tissues.

Treatment involves emergency surgery to remove dead and infected tissue. If the wound is in an extremity, amputation may be needed to stop the spread of infection. IV antibiotics, preferably penicillins and clindamycin, are required.

Wound classifications help determine risk for infection and if preoperative antibiotics are needed.

<table>
<thead>
<tr>
<th>Surgical Category (Infection Risk)</th>
<th>Defining Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class I: Clean</strong> <em>(1%–3%)</em></td>
<td>Site not traumatized, inflamed or infected. No break in aseptic technique. No entry into respiratory, genitourinary, gastrointestinal, or oropharyngeal tracts. Incision will be sutured closed; closed drain may be present.</td>
</tr>
<tr>
<td><strong>Class II: Clean-Contaminated</strong> <em>(3%–7%)</em></td>
<td>Entry into respiratory, genitourinary, gastrointestinal, or oropharyngeal tracts but no unusual contamination. Minor break in aseptic technique. Mechanical drainage. Wounds with an open drain (Penrose drain).</td>
</tr>
<tr>
<td><strong>Class III: Contaminated</strong> <em>(7%–16%)</em></td>
<td>Open, fresh, accidental wound. Gross spillage from intestinal tract. Major break in aseptic technique. Entry into genitourinary or biliary tract when urine or bile is infected.</td>
</tr>
<tr>
<td><strong>Class IV: Dirty</strong> <em>(16%–29%)</em></td>
<td>Traumatic wound with delayed repair and devitalized tissue, foreign bodies, or fecal contamination. Acute inflammation or purulent drainage encountered during procedure.</td>
</tr>
</tbody>
</table>
Atelectasis

- Atelectasis (alveolar collapse) is the most common postoperative respiratory complication.
- The pathophysiology is collapse of alveoli, either partially or totally, with subsequent lack of gas exchange.
- Postoperative atelectasis is caused by:
  - Respiratory depressive effects of general anesthesia.
  - Decreased inspiratory effort related to incisional pain, especially after abdominal or thoracic surgery.
  - Mucous plugs in larger airways.
- Opioid analgesics, tight bandages, abdominal distention, and reduced mobility all increase the likelihood of atelectasis.
- Smokers and elderly adults are at increased risk.
- Any decrease in alveolar airflow allows secretions to collect, which increases the risk of pneumonia.
- Most cases of postoperative atelectasis are mild, and the patient may have no symptoms. Detection of atelectasis in these cases is usually through routine lung auscultation or by chest x-ray ordered for another reason.
- In some cases, the patient may feel short of breath and have low $O_2$ saturation levels.
- Diminished breath sounds are heard in both bases with fine crackles on inspiration.
- C&DB exercises along with incentive spirometry use will help reinflate the alveoli and clear any secretions. Teach the patient how to perform these exercises effectively and remind him or her to do them every 2 hr while awake.
- Before having the patient demonstrate C&DB, teach him or her how to splint the incision to reduce tension on the suture line and minimize pain. Assure him or her that the incision will not open with coughing.
- Help the patient ambulate as soon as possible after surgery and set up an ambulation schedule and how far to walk. Activity will help inflate the collapsed alveoli and help overcome other effects of anesthesia. Check the patient’s activity orders first and make sure you do not overtire him or her.
- Some patients need supplemental $O_2$. Monitor pulse oximetry routinely, and assess levels before and after C&DB exercises.
In severe cases, continuous positive airway pressure (CPAP) or mechanical ventilation may be required.

### Venous Thromboembolism (VTE)

- VTE is an umbrella term to describe the clinical condition of DVT and its frequent complication, pulmonary embolism (PE).
- VTE is common in hospitalized patients. It can be fatal or have long-term effects. Patients with a single episode of VTE are at increased risk for a second episode.
- DVT usually presents with classic signs of inflammation such as redness, swelling, increased warmth of affected tissue (calf muscle), and pain. Ultrasound of the affected leg is the diagnostic test of choice. D-dimer testing can rule out DVT.

**QI:** Assessing patient’s for calf pain, tenderness, or swelling should be routine after surgery.

- PE usually presents as dyspnea, tachypnea, and pleuritic chest pain. Computed tomographic pulmonary angiography (CTPA) has replaced ventilation/perfusion (V/Q) scans as the diagnostic test of choice for PE.

- Risks for VTE include:
  - Obesity.
  - Previous VTE.
  - Advanced age.
  - Comorbid active malignancy.
  - Prolonged immobility.
  - Genetic variability in clotting.
  - Multiple trauma.
  - Hip fracture.
  - Spinal cord injury.

<table>
<thead>
<tr>
<th>Risk of VTE*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk Level</strong></td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
</tbody>
</table>

*Continued*
Prevention strategies include:

■ Intermittent pneumatic compression devices.
■ Prophylactic anticoagulants.
■ Leg exercises while hospitalized.
■ Ambulation as soon as possible after surgery and frequently thereafter.
■ If antiembolism stockings are used, thigh-high stockings are better than knee-highs.
■ Pneumatic compression devices should not be used if DVT is suspected.

■ Treatment involves anticoagulation with LMWH for DVT.
■ A filter in the vena cava may be placed to prevent clots from entering the lungs, although this practice may be reconsidered due to fracturing of the filters with subsequent cardiac complications. Removal of filters is an option, although it may be difficult because of local fibrosis.
■ PE is treated with either unfractionated heparin or LMWH followed by warfarin.

### Acute Urinary Retention

■ Urinary retention is fairly common after surgery, especially if the patient has been catheterized for a day or two.
■ Patients must void within 8 hours of surgery or removal of the urinary catheter. Have the patient drink plenty of fluids, at least four glasses (if allowed).
Any measure that helps the patient feel more comfortable when he or she attempts the first void, such as using a bedside commode instead of a bedpan, should be implemented.

Several techniques have been used to help trigger spontaneous voiding, although they may or may not work:
- Placing the patient’s hand in warm water.
- Pouring warm water over the perineum (female patients).
- Having the male patient stand to void.
- Placing a warm washcloth on the perineum.

If the patient voids without apparent difficulty, first note if the quantity of urine is in the expected range. Voiding <100 mL would be unusual if the patient has consumed several glasses of fluids.

Regardless of whether the amount is large or small, ask the patient if he or she feels as though the bladder is completely empty.

Next, palpate the bladder to assess for retention. If you can palpate the bladder at all, it means there is retained urine. This suspicion is augmented by the patient’s complaint of tenderness or urge to void when palpated. Use a bladder scan to assess postvoid volume.

If the patient is unable to void or feels as though he or she has not fully emptied the bladder, if you can palpate the bladder, or if the bladder scan is positive, catheterize the patient and document the amount of residual urine.

If the residual volume is <50 mL, no further catheterizations are required (unless the patient’s condition changes).

If the residual is >100 mL, catheterizations to determine postvoid residuals (PVR) will continue until the PVR is <50 mL.

Nausea, Vomiting, Ileus

General anesthesia causes temporary cessation of all bowel activity.

This temporary disruption of peristalsis may cause:
- Nausea, vomiting, and anorexia.
- Abdominal distention.
- Decreased or absent bowel sounds.

Nausea and vomiting are usually controlled with medications and maintaining NPO or NPO except ice chips status until nausea resolves.

Be sure to enforce dietary orders such as NPO, liquids only, soft foods only, etc. Stressing the bowel with too-rapid advancement of diet can cause complications.
The patient is also at risk for an ileus (intestinal obstruction), especially if the surgery involved the GI tract and if the patient is receiving opioids postoperatively.

Signs and symptoms of ileus include:
- Markedly diminished or absent bowel sounds.
- Abdominal distention.
- Vomiting, nausea, cramping.

An ileus is usually treated with a NGT, which decompresses the bowel (removes air and fluid) and gives it a chance to rest and recover.

The patient remains NPO, and IV fluids are continued.

Once bowel sounds return and the patient begins to pass intestinal gas, the NGT can be removed. Food and fluids are then resumed, starting with liquids and progressing as tolerated.

If the ileus does not resolve with conservative treatment, surgery to remove adhesions or untwist loops of bowel is performed.

To prevent or detect these complications, auscultate BS every shift, maintain restricted diets as ordered, encourage ambulation as tolerated, ask patient to report first passage of flatus and stool.
PAIN

Pain is defined by the International Association for the Study of Pain as “an unpleasant sensory and emotional experience arising from actual or potential tissue damage or described in terms of such damage.”¹

It is highly individualized, and only the person experiencing the pain can accurately describe it, relate its physical and emotional toll, and determine the effectiveness of treatment.

Pain is influenced by potent cultural norms, external circumstances, mood, memories, genetics, and many other psychosocial and biological factors.

Until recently, pain was thought to occur in this way:
- Something causes tissue damage.
- Pain sensors send a pain message to a pain center in the brain that is proportionate to the severity of the injury.
- This theory presumes that pain fibers send pain to the brain, but this is inaccurate. There are no pain fibers that detect pain or a pain center in the brain that records it.
- Instead, sensory nerves detect a stimulus that has the potential to cause harm. They then send warning messages that reach several areas of the brain. The brain decides how much danger is really present and what to do about it.
- In other words, pain is not necessarily commensurate with the patient’s physical state or the nature of the stimulus. It is more like an opinion—the brain’s sense of whether the body is in danger.
- We also know that our nervous systems can get “better” at feeling pain because of a number of factors. This is at the root of persistent pain, which is difficult to treat effectively.

How Pain Works: Physiology of Pain

- **Nociceptors** (no-sih-sep-tours) are sensory nerve endings distributed throughout almost all body tissues. (Interestingly, one area that does not contain nociceptors is the brain.)
- Nociceptors detect the same sensations (mechanical pressure, irritation, or temperature) as other nerve endings but require more intensive stimuli to be activated.
- Once nociceptors are triggered, electrical impulses travel along the sensory nerve to other nociceptors at the spinal cord.
- At the spinal cord, chemicals such as substance P and various neurotransmitters influence how many messages get through the “gates.” Those that do are directed up the spinal cord through the brainstem and midbrain to the thalamus.
- At this point, the warning message has been received, but we have not felt pain. Remember that pain is a conscious experience, and whether we feel pain depends on what happens next.
- The thalamus relays the message to the following three areas, which are sometimes called the **pain matrix**:  
  - The somatosensory cortex, which identifies the origin and intensity of the signals.
  - The limbic system, which adds the emotional component.
  - The frontal cortex, which adds the cognitive component.
- On the basis of the contributions of these three areas, the brain decides how much danger is involved, what it means for our well-being, and which emotions to engage.
- The brain can then ramp up or tone down the pain so we can feel anything from no pain at all to intense pain.
- This is accomplished by the brain sending messages to the spinal cord that increase the signals, diminish them, or stop them altogether.
- The brain also motivates us to action, telling us to move away or protect the body part.
Classifying Pain

Not all pain is the same, and various systems for classifying pain exist. One way to describe pain is by its duration:

- **Acute pain** is pain that lasts less than 6 months. It also describes pain that is clinically expected, is more or less proportionate to the circumstances, and subsides as the condition causing the pain resolves.

- **Chronic or persistent pain** is pain that lasts longer than 6 months. It is often reported as moderate to intense and interferes with the patient’s quality of life.

- **Acute-on-chronic pain** is a flare-up of acute pain superimposed on chronic pain. An example of this can be seen in patients with rheumatoid arthritis whose disease becomes active and causes worse than usual pain.

See the table “Classifying Pain by Location” for other ways to categorize pain. The terms included can be useful in describing pain.

A method of classifying pain by the physiological mechanisms involved, developed by pain specialist Dr. Clifford Woolf, divides pain into three categories: nociceptive, inflammatory, and pathological.

### Nociceptive Pain

- The term nociceptive pain is often used to describe musculo-skeletal pain resulting from tissue injury. Examples include incisional pain or pain from a broken bone but not nerve pain.
- However, the term nociceptive pain has been used more recently to refer only to the pain we feel when we are in danger of sustaining injury. This pain warns us of actual or potential threats to body integrity and then provokes us to immediate action to minimize exposure to the threat.
- Examples of nociceptive pain and the protective responses include withdrawing your hands from too-hot water, drinking water quickly after biting into a hot pepper, or changing your position because your ankle is twisted.
- It is induced by brief high-intensity stimuli, results in little or no tissue damage, and disappears rapidly.

### Inflammatory Pain

- Inflammatory pain refers to the pain we feel once tissue has been injured, whether the injury is from trauma, surgery, infection, a broken bone, inflamed nerve, or other cause.
This pain occurs because injury initiates an inflammatory response and the release of chemicals such as bradykinin and histamine. Immune cells including macrophages, neutrophils, granulocytes, and mast cells flood the area, releasing cytokines and other substances. These chemicals increase the sensitivity of nerve endings in the damaged area.

Because the nerve endings are now hypersensitive, pain can be induced by stimuli not normally considered pain inducing. For example, think of the pain generated by gently twisting your sprained ankle, putting pressure on a new incision, or bending at the waist when the sciatic nerve is inflamed.

Inflammatory pain also serves an adaptive purpose. It reminds us to protect and treat the injured area until it heals.

As the area heals, pain and tenderness often diminish and then subside completely.

However, the changes brought on by inflammatory mediators can sometimes become fixed, leading to pathological pain.

Pathological Pain (Chronic Pain)

Woolf defines pathological pain as “pain that is not protective, but maladaptive, resulting from abnormal functioning of the nervous system.”

When pain results from actual nerve damage, as in a spinal cord injury, it is called neuropathic pain. When it occurs in the absence of nerve damage or any significant inflammation, it is called dysfunctional pain. This type of pain affects millions of people.

If you think of pain as a fire alarm, nociceptive pain represents the appropriate triggering of the alarm when it first senses smoke. Inflammatory pain represents triggering of the alarm when it is getting warm. Pathological pain represents a “false alarm” caused by a malfunction in the alarm itself.

These false alarms are thought to result from structural changes over the entire pain-sensing network, causing it to be hypersensitive.

The changes are brought on by exposure to inflammatory mediators, which can profoundly alter the function of peripheral nerve fibers and their synapses in the central nervous system.

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<table>
<thead>
<tr>
<th>Classification of Pain by Location</th>
<th>Symptoms</th>
<th>Tissues Affected</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial</td>
<td>Sharp, burning, lancinating, muscle spasm or cramping, tenerness (hypoesthesia), numbness, tingling, tightness, light- and deep aching</td>
<td>Muscles, tendons, skin, mucous membranes</td>
<td>Trauma such as superficial injuries, burns, cuts, or scratches</td>
</tr>
<tr>
<td>Visceral</td>
<td>Sharp, burning, lancinating, muscle spasm or cramping, tenerness (hypoesthesia), numbness, tingling, tightness, light- and deep aching</td>
<td>Muscles, tendons, skin, mucous membranes</td>
<td>Trauma such as superficial injuries, burns, cuts, or scratches</td>
</tr>
<tr>
<td>Neuropathic</td>
<td>Burning, electrical, lancinating, muscle spasm or cramping, tenerness (hypoesthesia), numbness, tingling, tightness, light- and deep aching</td>
<td>Muscles, tendons, skin, mucous membranes</td>
<td>Injury, overuse, ischemia, tumor, compression, infection, transplantation, disease, pancreatitis, peptic ulcer disease, trauma, compression, tumor, sensitization</td>
</tr>
</tbody>
</table>
The result is that pain becomes easier to trigger, more intense, spread over a larger area, and longer lasting. This is called central sensitization and is the mechanism behind what is often called chronic pain, pain that is resistant to treatment.

Patients with Pain

- Everyone, except those few people with a genetic mutation, has experienced pain. It is the most common reason people seek medical care.
- Whether patients have acute inflammatory pain after an injury or surgery or chronic pathological pain, you will encounter patients in pain throughout your nursing career.

Pain Assessment

- A pain assessment should be part of any nursing admission assessment. If the patient denies any current or recent history of pain, you can move on. However, if the patient is in pain, you should take a pain history.
- First, ask questions that will differentiate between inflammatory pain and pathological pain. Inflammatory pain is caused by a current medical problem. For example, an inflamed pancreas (pancreatitis) causes abdominal pain. Pathological pain is pain that has remained long after the inflamed tissues have healed.
- Ask about when it started, what the patient thinks caused the pain, and what treatment he or she has taken for the pain.
- Have the patient rate the pain using a verbal/numerical analog scale.

<table>
<thead>
<tr>
<th>Numeric Pain Scale</th>
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<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>No pain</td>
</tr>
</tbody>
</table>
Although we cannot say whether a patient-described level of 6 feels like what we feel when we have level 6 pain, generally there is consistency between the numbers and the corresponding descriptors across patients. In other words, a patient who rates the pain as a 4 will most likely also describe it as moderate.

Keep in mind, however, that these scales reflect only one aspect of pain: intensity.

Next use the PQRST assessment tool to get a better sense of the patient’s pain.

<table>
<thead>
<tr>
<th>PQRST – Pain Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P</strong> (provokes/point)</td>
</tr>
<tr>
<td><strong>Q</strong> (quality)</td>
</tr>
<tr>
<td><strong>R</strong> (radiation/relief)</td>
</tr>
<tr>
<td><strong>S</strong> (severity/signs/symptoms)</td>
</tr>
<tr>
<td><strong>T</strong> (time/onset)</td>
</tr>
</tbody>
</table>
For patients with chronic pathological pain, the Brief Pain Inventory or the McGill Questionnaire are excellent tools that assess the multidimensionality of pain, treatment effectiveness, and effect of pain on the patient’s daily living. Both tools are lengthy and not reproduced here.

Ask the patient with pathological pain if he or she sees a pain specialist, what the current treatment involves, and if it is effective.

Always ask the patient directly if he or she would like medication for the pain.

Perform pain assessment quickly but thoroughly before medicating. Always find out whether the pain is new and different; if it is consistent with the patient’s diagnosis, procedure, or surgery; or if it is typical and expected. **New-onset pain or pain that is unusual for the diagnosis, procedure, or surgery must be evaluated by the physician, PA, or NP as soon as possible.**

Contact a pain care nurse if available.

**Pain Assessment in the Nonverbal or Confused Adult**

Pain in nonverbal or confused patients is sometimes overlooked because assessment is difficult. For these patients, a combination of other assessment strategies should be used:

- **Self-Report.** Even if seems pointless to you, ask the patient if he or she is in pain. The patient may be able to shake his or her head or give a yes/no answer.

- **Search for Potential Causes of Pain.** Conditions or procedures that cause pain in alert and oriented patients will most likely cause pain in nonverbal or confused patients.

- **Observe Patient Behaviors.** If the patient cannot answer questions about pain, observe his or her behavior. Grimacing, crying, restlessness, load vocalizations, even loud singing can indicate pain. Other behaviors that may indicate pain include the following:
  - Rigid, tense, posture, guarding of an area, decrease in motor activity.
  - Aggressiveness, resisting care, withdrawing from interactions.
  - Massaging a body part, rocking, groaning, teeth clenching.
  - Cursing or saying things such as, “Don’t touch there” or “That hurts” during routine assessment or movements.

- **Family member reports.** Ask family members if the patient has had pain and how he or she behaves when in pain.
Analgesic trial. When procedures or conditions are known to cause pain or when behaviors seem to indicate pain, administering an analgesic and then observing the patient’s behavior for evidence of improved comfort level is appropriate.

- It is important to be as certain as possible that the patient’s behavior indicates pain. For example, aggressive behavior often does not indicate pain but is a symptom of Alzheimer’s disease. Using a validated behavioral assessment tool such as the Checklist of Nonverbal Pain Indicators or the Assessment of Discomfort in Dementia (ADD) Protocol will help prevent misattribution and add consistency to the assessment across caregivers.

- The strength of the pain medicine should be titrated to the estimated intensity of the pain. If pain is estimated to be mild or moderate, acetaminophen can be given. If the pain seems moderate or severe, start with a low-dose opioid and carefully titrate upward.

- It is equally important to be sure that changes in behavior after administering analgesics signify increased comfort. Sedation or sleeping do not indicate pain relief.

- However, if the patient is awake and appears more comfortable as evidenced by a relaxed facial expression, improved activity tolerance, or cessation of out-of-character behaviors, it is safe to say that he or she has obtained pain relief.

Patients who are critically ill and on ventilators cannot self-report pain. The Critical Care Pain Observation Tool (CPOT) uses facial expression, muscle tension, body movements, and ventilator compliance as pain indicators.

Try nonpharmacological treatments if appropriate.

Reassess the patient after intervention and regularly throughout their hospitalization.

To prevent misuse of pain medications or overlooking more appropriate interventions, all nurses caring for the patient should use the same method or measure for assessing pain.

Recommend that your facility adopt a specific tool for assessing pain in nonverbal patients.
Pain Treatment

General Principles

■ Because the experience of pain is multidimensional, pain treatment is more effective when multiple modalities are used.
■ Administer analgesics before pain becomes severe. For patients with pain that does not diminish throughout the day, round-the-clock dosing is preferred.
■ Provide comfort without sedation. The patient needs to be able to maintain alertness and function.
■ Do not assume the patient’s pain is exaggerated because he or she asks for pain medicine frequently. Look for ways to better manage pain.
■ Differentiate between acute and chronic pain. Patients in chronic pain may not exhibit physiological signs associated with pain.
■ Reassure patients that pain can be relieved.
■ Assess any changes in pain pattern to ensure that new causes are not overlooked.
■ Try the least invasive route first in patients with cancer or chronic pain. Keep dosage schedules simple.
■ Monitor side effects. Use prevention strategies, especially for constipation, when opioids are used.
■ Be careful when switching from oral route to intravenous (IV), intramuscular (IM), intrathecal (IT), or other route. Dosages change, and different drugs may not provide as much pain relief. Use an equianalgesic dosing table for guidance.
■ Teach or arrange for instruction in relaxation exercises, hypnosis, and other nonpharmacological interventions; all can reduce pain and stress and give a greater sense of control.
■ Do not avoid opioids because of fear the patient will become addicted.
■ Suggest administering medication on a round-the-clock schedule to maintain therapeutic blood levels.
■ Suggest time-released pain medications to avoid peaks and valleys in pain control.
■ Consult with a pain management clinical specialist.
■ Include family in developing a pain control plan.
■ Pain treatment should address all aspects of the pain experience. How you approach the patient, your attitude, nonpharmacological interventions, and pain medications all have roles in pain treatment.
Pain Medications

Nonopioid Medications

- Nonopioid medications are used to treat mild to moderate pain.
- Aspirin and other nonsteroidal anti-inflammatory pain medications (NSAIDs) work at peripheral nerve endings by inhibiting prostaglandin synthesis, which makes nociceptors more sensitive. Anti-inflammatory drugs have significant side effects. They can cause:
  - Venous thromboembolism.
  - Hypertension.
  - Gastrointestinal ulceration, bleeding, or perforation.
  - Anaphylactic reactions.
  - Increased clotting time.
- The smallest effective dose given for the shortest amount of time is recommended. Aspirin dosage should not exceed 4,000 mg/day.
- Tylenol is a nonopioid analgesic that appears to work by elevating the pain threshold. It can cause liver damage or failure. The maximum 24-hour dose limit is 4,000 mg for patients who do not have a history of liver or kidney disease and 2,000 mg for those who do.

Opioid Medications

- Opioid medications are used to treat moderate to severe pain. If combined with nonopioid medications such as acetaminophen or aspirin, they may be used for moderate pain because of the dose limits on the nonopioids.
- Opioids bind to receptors in the peripheral and central nervous system, blocking the transmission of signals from nociceptors.
- Morphine, fentanyl, oxycodone, and hydromorphone are the most commonly used opioids.
- Opioids can be given by oral, sublingual, rectal, transdermal, IV, subcutaneous, or epidural routes. Oral administration is the preferred route for patients able to take foods and fluids. IV or subcutaneous administration is recommended when patients are NPO or when rapid onset of action is preferred. Intramuscular administration is not recommended due to erratic absorption. See the next section for detailed information on patient-controlled analgesia (PCA).
Generally patients on opioids take a basal or time-released dose along with bolus or immediate-release doses for breakthrough pain. Significant side effects include nausea, vomiting, sedation, respiratory depression, and constipation.

**RI** Ongoing assessment for sedation and respiratory depression are critical. Narcan (naloxone) is an opioid antagonist and reverses the effects of opioids immediately.

**Patient-Controlled Analgesia**

- PCA is used in hospital settings to treat acute pain.
- Pain medication is loaded into an infusion pump, which is programmed according to the physician’s order.
- The orders usually give a basal and a bolus rate. The basal rate is an hourly rate that the pump administers on its own. The bolus dose is the amount of additional medication the patient can self-administer by pushing a button.
- Too frequent self-administration is prevented by programming how often the bolus dose can be administered. This **lockout period** is usually between 15 and 30 minutes.

**Safety Issues: Proper Patient Selection**

- PCA should be used in certain patients only with extreme caution. These include:
  - Patients who are confused or disoriented or who become so at night (sundowning).
  - Patients diagnosed with sleep apnea or obese patients at risk for sleep apnea.
  - Patients on medications that potentiate opioids, such as muscle relaxants, anxiolytics, antiemetics, and sleeping medications.

**Safety Issues: PCA by Proxy**

- PCA by proxy is the administration of a bolus dose of IV PCA medication by someone other than the patient in an attempt to keep the patient comfortable.
- **Fatal overdoses have been delivered unintentionally in this manner.**
- Some facilities believe an “authorized agent”—a nurse or family member—can administer PCA boluses to provide analgesia for patients who cannot self-administer doses. In those instances, detailed orders, assessments, and sedation parameters must be in place to guide administration.
To prevent serious adverse events or death, never administer a bolus dose of PCA medication for a sleeping or sedated patient. Instruct family members or friends never to do so either.

Safety Issues: Human Errors

- Incorrect programming of the infusion pump can lead to overdosing or underdosing. Errors are related to:
  - Confusing milliliters and milligrams.
  - Confusing PCA bolus doses and a basal rate.
  - Loading dose programmed as the basal rate.
  - Incorrect lockout settings selected.
  - Incorrect concentration selected.

Preventing PCA Adverse Events

- Learn to use the PCA pumps in your facility and maintain proficiency. To reduce the risk of confusion, suggest to your quality improvement department that the same model of PCA pump be used throughout your facility.
- Clarify any uncertainties in the orders.
- If you think the patient is a poor risk for PCA use, notify the physician, PA, or NP with your concerns. Document your phone call, the provider’s response, and the plan to reduce risk.
- When initiating PCA, have another nurse independently check the patient’s ID, the drug and concentration, the PCA pump settings, and the line and site where the PCA drug will be infusing.
- Suggest using both pulse oximetry and capnography (measurement of end-tidal carbon dioxide content [ETCO₂]) to monitor signs of respiratory depression (Spo₂ <91% or ETCO₂ >45 mm Hg).
- Monitor level of sedation: If the patient drifts off during conversation or does not respond to gently shaking the shoulder or calling his or her name, the patient is oversedated and immediate action is required. Do not be fooled: Patients who respond only to vigorous shaking or their name being called loudly are oversedated. Patients should respond to minimal stimulation.
- Screen patients for obstructive sleep apnea (OSA); patients with OSA should not have a basal rate due to the potential for severe respiratory depression, hypercapnia, and hypoxia during sleep.
- Educate all family members about the danger of administering bolus doses for the sleeping patient.
Adjuvant Analgesics
- Adjuvant drugs are coadministered with other analgesics to enhance the pain-relieving effects by targeting other pain producing processes.

Local Anesthetics
- Local anesthetics are available in creams, gels, or transdermal patches. They induce analgesia by blocking sodium ion channels, which prevents the conduction of nerve impulses.
- Transdermal patches are probably the most convenient to use. They should be applied to intact skin directly over the painful area. Leaving the patches on for longer than the recommended limit (8 hours) can cause skin irritation.
- Lidoderm (lidocaine 5%) is a commonly used patch.

Anticonvulsants
- Antiepileptic drugs used in the treatment of pain have various modes of action but generally stabilize nerve membranes, diminish nerve excitability, and reduce spontaneous firing.
- They are helpful alone or in combination with opioids in the treatment of persistent neuropathic pain from fibromyalgia, spinal cord injury, postherpetic neuralgia, trigeminal neuralgia, and other nerve injuries. They also may be useful in preventing persistent postoperative pain syndromes.
- Anticonvulsant side effects include sedation, suicidal thoughts, and angioedema. They should not be discontinued abruptly.

Antidepressants
- Tricyclic antidepressants, selective serotonin reuptake inhibitors (SSRIs), and serotonin and norepinephrine reuptake inhibitors (SNRIs) are commonly prescribed as adjuvants to opioid analgesics or anticonvulsants even if the patient is not depressed.
- Their mechanism of action in pain relief is not well understood, but they may increase levels of neurotransmitters in the spinal cord that block nerve transmission.
- They are used to treat diabetic neuropathy, arthritis, pelvic pain, low back pain, and other persistent neuropathic pain syndromes.
- They can cause dry mouth, weight gain, constipation, dysrhythmias, sedation, and postural hypotension. They are also associated with suicidal ideation.
Nonpharmacological Treatment of Pain

■ Nonpharmacological interventions for pain are not used as much as they should be, even though they can be helpful. In addition to reducing pain, nonpharmacological interventions help the patient by:
  ■ Increasing sense of control and ability to care for self.
  ■ Improving activity tolerance and functioning.
  ■ Reducing stress and anxiety.
■ Nonpharmacological therapies are mostly noninvasive and can be self-taught. Some therapies involve treatment by professionals.
■ One important nonpharmacological treatment involves health care providers, particularly nurses and physicians.

Health Care Providers’ Attitudes Toward Patients in Pain
■ Experiencing a health scare, injury, surgery, or hospitalization is a traumatic event. In addition, we often feel helpless in the face of these events because we do not know what is going on, how things will work out, or how to take care of ourselves.
■ Keep in mind that pain is influenced by emotions such as fear, and consider the types of messages the patient receives that reinforce the negative aspects of an illness or injury.
■ Patients often hear such comments as:
  ■ “You have the worst case of X I have ever seen.”
  ■ “Your (knee, shoulder, intestinal scar tissue) was really bad, but I did my best.”
  ■ “That must really hurt!”
  ■ “That is a nasty wound.”
  ■ “You seem to have more pain than other people.”
  ■ “We cannot find any physical reason for your pain.”
■ These types of messages either compound the patient’s feelings of fear and helplessness or invalidate their feelings of pain.
■ In addition, patients do not always get affirming messages such as, “You’ll feel better if you get out of bed and walk a little” instead of “I know it’s hard, but let’s try it.”
■ You may think that saying something such as “That must really hurt” validates the patient’s pain; in a way it does. But there is a fine line between accepting the patient’s reports of pain and subtly reinforcing it. And it does not address the issue of failing to empower the patient with positive messages.
Better approaches include the following:
- Developing trust by providing information, listening to the patient talk about the pain, and suggesting realistic actions the person can take that will deliver a better sense of control. These actions may not have a direct effect on pain but increase the patient’s sense of well-being, which can decrease the brain’s sense of danger.
- Acknowledge that pain is real but add a positive message such as “Surgery is painful, but you can help yourself by taking medication when the pain is mild and then taking a walk or sitting out of bed, which will help you recover.”
- Avoid making the kind of negative comments described earlier without unrealistically minimizing the patient’s condition. For example, a patient is admitted to the hospital for surgery the next day because he crushed several fingers. He received pain medication 2 hours before but says his hand is still extremely painful. Instead of saying, “You have a really bad injury” or “You just had strong medicine a little while ago; it should not be hurting by now,” you might say, “I can see that you are still in pain” and then discuss with the patient and physician, NP, or PA if the dosage or type of medicine was adequate. You can also suggest nonpharmacological interventions (discussed next) as an adjunct to the medication and give the patient an opportunity to talk about his concerns.

**Hypnosis**
- Contrary to popular portrayals of hypnosis, hypnosis does not put a person under the control of another.
- Hypnosis alters the person’s state of consciousness such that he or she is in a deep state of relaxation. While in this state, the therapist can make suggestions to the patient about alternative ways to manage pain.
- Although hypnotic suggestions should be individualized to each patient, some common themes include suggesting that the patient:
  - Focus thoughts on a peaceful, relaxing scene.
  - Imagine being transported to a time before the pain began.
  - Think of the pain as a hot sensation and visualizing it being cooled off.
Relaxation and Deep-Breathing Techniques

- Relaxation and deep-breathing techniques are both forms of distraction that have additional benefits.
- Deep relaxation can be accomplished by listening to a therapist who guides you through various steps or by performing the steps alone.
- The patient begins the process by focusing on deep breathing and then consciously relaxing muscle groups.
- Next, the patient can focus on a positive “force” visualized as a color, light, sound, or other device of the patient’s choosing and direct it to reduce pain or imagine healing.
- Like hypnosis, deep-relaxation techniques should be tailored to the individual to achieve maximum benefit.

Distraction

- Distraction techniques are easy to implement. Listening to music, watching a movie, and engaging in social interactions are examples of simple interventions that focus the patient’s attention away from the pain.
- Sometimes pain is too severe for distraction to work well or at all. If the patient says he or she cannot focus on anything but the pain, he or she should receive pain medicine.

Meditation

- Meditation is a technique for reducing stress. Usually, the patient begins by focusing on breathing, perhaps by paying close attention to the sensation of air entering and leaving the nostrils. At the same time, the patient tries to empty his or her mind of thoughts by consciously watching thoughts float away.
- Meditation takes practice but has been shown to have many psychological and physical benefits.
- Chanting a prayer to oneself can have similar effects; it provides distraction and can induce relaxation and reduce stress.
Support Groups
- Patients with pathological pain often feel that their family and friends do not understand what they are going through. They may not want to talk about the pain because of negative feedback.
- Patients often feel isolated and even useless if they have been unable to work or contribute physically around the house. Physical affection may be difficult for them because of their pain.
- A support group is an excellent way to ventilate feelings, diminish social isolation, work out problems, and reduce stress.
- Pain support groups often meet in hospitals, but online groups may be much easier to attend and are available 24/7.

Physical Therapy
- Traditional physical therapy is often prescribed for patients with chronic pain.
- The therapist can teach the patient ways to strengthen supportive muscles so that they can exercise better without exacerbating pain.
- Often patients with chronic pain are deconditioned secondary to their health problems and pain. Improving overall condition helps the patient’s general sense of well-being as well as improving activity tolerance and mobility.

Massage and Acupressure
- Massage helps to loosen tense muscles and induce relaxation. It enhances well-being.
- Acupressure involves applying pressure to points on your body that lie along meridians. Chinese medicine associates these meridians and points with energy (qi) circulation and balance.
- Both massage and acupressure are thought to enhance the release of endogenous endorphins that help reduce pain and the levels of stress hormones such as cortisol and norepinephrine. This results in lowering heart rate, blood pressure, and respirations.

Acupuncture
- Acupuncture is an invasive modality that patients cannot do at home.
- A recent meta-analysis suggested that acupuncture is effective in reducing pathological pain.3
- The reductions were modest but may be beneficial for some patients.

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Avoiding Errors in Critical Thinking

Critical thinking involves synthesis and evaluation of information. It clarifies the issues and their meaning. It is important to acquire habits of thought that minimize the possibility of error.

- An **availability error** occurs when you overestimate or underestimate the likelihood of an explanation because of more recent or more memorable events.
- **Premature closure** occurs when you arrive at a conclusion about the patient’s condition and then stop gathering data.
- An **anchoring error** occurs when you fail to properly consider data that conflicts with your conclusion.
- **Confirmation bias** occurs when you give greater credence to data or experiences that support your opinion and ignore those that do not.

**Minimizing Cognitive Errors**

- You can incorporate specific strategies into your thinking to help minimize cognitive errors.
- After you gather data about a patient, you arrive at a conclusion about what the underlying problem may be. To enhance your critical thinking, ask yourself several questions:
  - How do I precisely define the patient’s problem(s)?
  - If this is not the explanation, what else could be going on?
  - What are the most dangerous complications that could explain this situation?
  - Have I overlooked any important details?
  - How do the signs and symptoms relate to my conclusion?
  - Is there any patient data that is at odds with my explanation?
  - Do I have the depth of knowledge I need to accurately explain the signs and symptoms?
  - Do I need to contact another nurse, a physician’s assistant (PA), or the physician with this information?
  - What are the implications of these data for the patient?
  - What is the safest course of action for the patient at this time?
- Consider the foregoing questions when thinking about this true patient scenario:
  
  Nurse A works on an orthopedic surgical unit. She has a 55-year-old man who underwent repair of a compound fracture of the femur 3 days earlier. It is 10 AM and the patient has not voided since the previous evening. She notes that his abdomen is rounded and
believes this to be bladder distention from postoperative urinary retention, which is fairly common on her unit. She checks the chart for an order to straight cath the patient if unable to void. There is such an order, so she catheterizes the patient but no urine returns. Knowing that it is sometimes difficult to catheterize men, she seeks the help of an older nurse with experience in urology. She tells Nurse B that she cannot get the catheter into the bladder. Nurse B enters the room and is immediately alarmed. Just a few seconds of observation tells her the following:

- The patient has a grossly distended abdomen.
- He is restless and writhing in the bed.
- His skin is mottled.

She quickly ascertains that the catheter is in the patient’s bladder but believes the reason no urine has returned is because the patient is most likely not making urine. He may be in acute renal failure and appears gravely ill. She checks his vital signs: he has a fever, his blood pressure, heart rate, and respiration are all somewhat elevated. She notifies the resident on call immediately, telling him the patient “looks septic.” While nurse A stays with the patient, nurse B checks his laboratory work. She finds that he has a white blood cell count >50,000, which she tells the physician as he enters the room. Urgent interventions are begun, and the patient is rapidly transferred to the intensive care unit, where he died a few hours later of peritonitis. Upon investigation, it was learned that a nurse had administered a small-volume enema 2 days earlier. When asked if anything unusual happened, she stated she had heard a “pop” during administration. Ask yourself how things might have been different if Nurse A or the nurse who had administered the enema had asked herself even a few of these questions.

### Errors in Nurse A’s Critical Thinking

- **How do I precisely define the patient’s problem(s)?** Nurse A defined only part of the problem: no urine output.
- **If this isn’t the explanation, what else could be going on?** The nurse did not ask herself this question because of the frequency with which she had to catheterize patients after surgery in the past. She made an availability error.
- **What are the most dangerous complications that could explain this situation?** It doesn’t appear that she asked herself this question because of confirmation bias.
Have I overlooked any important details? Nurse A did not ask this question and instead made a premature closure error.

How do the signs and symptoms relate to my conclusion? Several of the patient’s signs and symptoms did not relate at all to urinary retention.

Are there any patient data that are at odds with my explanation? Yes, there was significant data at odds with the conclusion. She made an anchoring error in that she ignored his extreme restless, mottled skin, and elevated vital signs. Other than perhaps some mild restlessness, none of these is associated with urinary retention.

Do I have the depth of knowledge I need to accurately explain the signs and symptoms? Nurse A did not consider this because she made the availability and premature closure errors.

Do I need to contact another nurse, a PA, or the physician with this information? She did do this.

What are the implications of this data for the patient? The implications were fatal, but again, Nurse A failed to consider all the data.

What is the safest course of action for the patient at this time? Tragically, this was not considered by the nurse who administered the enema. When she heard the unusual “pop,” which was the bowel lumen bursting, she should have informed the physician, or at least her supervisor, immediately.

Learn to automatically ask yourself these questions; you will enhance your critical thinking abilities and provide safer, higher quality care.

Guide for Detecting Deteriorating Status

Detecting a decline in the patient's condition early is critical to minimizing complications and death. Likewise, it is critical that help is summoned from the physician, PA, or NP so that urgent interventions can be implemented. The term “failure to rescue” is used to describe instances in which the deterioration of the patient’s condition was not recognized or was recognized but not acted on. The following guidelines will help you determine what changes in patient status are cause for concern and what actions should be taken. This is just a guide and it is always best to notify the health care provider or your supervisor promptly if have any doubts about your assessment findings and what they mean for the patient. Refer to the critical thinking guide as well.
Tools

Early Warning Score (EWS) System

<table>
<thead>
<tr>
<th>Level of Consciousness **</th>
<th>V, P, or U</th>
<th>A</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>Needs Oxygen?</th>
<th>Oxygen Satz</th>
<th>Respiratory Rate</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm Hg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≥220 mm Hg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heart Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≥101-130 beats/ min</td>
<td>≥102.4°F (≥39.1°C)</td>
<td>≥100.6°–102.2°F (≥38.1°–38.5°C)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systolic BP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≥111-170 mm Hg</td>
<td>≥96%</td>
<td>≥94-95%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≥96°F</td>
<td></td>
<td>≥96°F</td>
<td></td>
</tr>
</tbody>
</table>

Developed by Royal College of Physicians. This tool assists but does not replace clinical judgment. Evaluation of changes in vital signs, level of consciousness, and oxygen saturation must take into consideration clinical context and patient's baseline.

* Refers to patients who MUST have supplemental oxygen to maintain adequate oxygen saturation.

** A = Alert; V = responds to Voice; P = responds to Pain; U = Unresponsive.
## Vital Sign Record

<table>
<thead>
<tr>
<th></th>
<th>Time:</th>
<th>EWS</th>
<th>Time:</th>
<th>EWS</th>
<th>Comment/Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SaO₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs O₂?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total EWS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sao₂ = oxygen saturation.

## Interpreting Scores

<table>
<thead>
<tr>
<th>Total Score</th>
<th>Assessment Frequency</th>
<th>Notify CRNP, PA, or Physician</th>
<th>Other Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–4</td>
<td>Every 4 hr by RN</td>
<td>RN decides if notification is necessary</td>
<td>If indicated</td>
</tr>
<tr>
<td>5–6 (or 3 in any one measure)</td>
<td>Every 2 hr by RN</td>
<td>Prompt assessment by CRNP, PA, or physician</td>
<td>Check blood glucose Monitor I&amp;O closely Screen for possible sepsis</td>
</tr>
<tr>
<td>≥7</td>
<td>Every hour by RN</td>
<td>Urgent assessment by physician</td>
<td>Transfer to ICU</td>
</tr>
</tbody>
</table>

I&O = intake and output; RN = registered nurse.
# Intake and Output Record

<table>
<thead>
<tr>
<th>Intake</th>
<th>Amount In</th>
<th>Output</th>
<th>Amount Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVF</td>
<td></td>
<td>Urine</td>
<td></td>
</tr>
<tr>
<td>IVPB</td>
<td></td>
<td>NG drainage/emesis</td>
<td></td>
</tr>
<tr>
<td>Blood/colloid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral intake</td>
<td></td>
<td>Liquid stool</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total in</td>
<td></td>
<td>Total out</td>
<td></td>
</tr>
</tbody>
</table>

IVF = intravenous fluids; IVPB = intravenous piggyback; NG = nasogastric.
## Labs/Diagnostics

<table>
<thead>
<tr>
<th>Time</th>
<th>Hematology</th>
<th>Cardiac Enzymes</th>
<th>General Chemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RBC</td>
<td>WBC</td>
<td>Hct</td>
</tr>
<tr>
<td>BUN</td>
<td>Blood urea nitrogen</td>
<td>Creatinine phosphokinase-MB</td>
<td>Lactate dehydrogenase</td>
</tr>
</tbody>
</table>

**Abbreviations:**
- **BUN:** Blood urea nitrogen
- **CPK-MB:** Creatinine phosphokinase-MB
- **Creat.:** Creatinine
- **Hct:** Hematocrit
- **Hgb:** Hemoglobin
- **Glu:** Glucose
- **INR:** International normalized ratio
- **LDH:** Lactate dehydrogenase
- **PT:** Prothrombin time
- **PTT:** Partial thromboplastin time
- **RBC:** Red blood cell count
- **WBC:** White blood cell count
- **ACT:** Activated partial thromboplastin time
- **PT:** Prothrombin time
- **INR:** International normalized ratio
- **PTT:** Partial thromboplastin time
- **Thrombin:** Thrombin time
- **MBD:** Myoglobin
- **Ca:** Calcium
- **K:** Potassium
- **Na:** Sodium
- **Cl:** Chloride
### Arterial Blood Gas Normal Interpretation Guide

**PATIENT RESULTS:**

<table>
<thead>
<tr>
<th>pH</th>
<th>PaO₂</th>
<th>Paco₂</th>
<th>Sao₂</th>
<th>HCO₃</th>
<th>Base Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Interpretation Guide

<table>
<thead>
<tr>
<th>Patient Results</th>
<th>N, A, B*</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td></td>
</tr>
<tr>
<td>CO₂ (respiratory)</td>
<td></td>
</tr>
<tr>
<td>HCO₃ (metabolic)</td>
<td></td>
</tr>
</tbody>
</table>

*A = acid; B = base (alkaline); N = normal.

- Enter patient values for pH, CO₂, and HCO₃.
- Enter N, A, or B in third column of each to reflect whether value is normal, acidic, or alkaline (base).
- Determine which matches pH.
- Whichever matches pH is source of problem. Write metabolic or respiratory.
- If pH is below normal, write in acidosis; if it is above normal, write in alkalosis.
- Refer to Respiratory tab for more instruction.


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