CHAPTER 3

PATIENT CARE AND SAFETY

STUDENT LEARNING OUTCOMES

After studying this chapter, the student will be able to:

1. Give clear verbal instructions to an ambulatory patient concerning the correct manner of dressing and undressing for a radiographic procedure.
2. Correctly assess a patient’s need for assistance to complete a radiographic procedure safely.
3. Demonstrate the correct method of moving and positioning a patient to prevent injury to the patient or the radiographer.
4. Demonstrate the correct method of assisting a disabled patient with dressing or undressing for a radiographic procedure.
5. List the safety measures that must be taken when transferring a patient from a hospital room to the radiographic imaging department.
6. Describe steps that must be taken as the radiographer to protect the patient’s integumentary system from injury.
7. Explain the criteria to be used when immobilization of a patient is necessary.
8. List the types of immobilizers available, and demonstrate the correct method of applying each one.
9. List the precautions to be taken if a patient is in traction or wearing a cast.
10. Demonstrate the correct manner of assisting a patient with a bedpan or urinal.
11. Explain the responsibilities of a radiographer concerning radiation safety.
12. List the departmental safety measures that must be taken to prevent and control fires, patient falls, poisoning or injury from hazardous materials, and burns as well as the measures to evacuate patients in case of a disaster.

KEY TERMS

Ambulatory: Walking, or able to walk
Atrophy: Decrease in the size of the organ, tissue, or muscle
Decubitus ulcer: A pressure sore or ulcer
Dyspnea: Labored or difficult breathing
Immobilizer: Velcro straps that are used on a patient’s limbs or waist to prevent a patient from injuring him or herself or others
Ischemia: Deficiency of blood in a body part due to functional constriction or actual obstruction of a blood vessel
Tissue necrosis: Localized death of tissue due to injury or lack of oxygen
Ulceration: An area of tissue necrosis that penetrates below the epidermis; excavation of the surface of any body organ
Appraising the profession and patients in a courteous and tactful manner can put the patients at ease and decrease their level of embarrassment so that the procedure can be performed in a smooth and timely manner. The radiographer sets the tone for the entire exchange when a patient arrives as an outpatient. The radiographer is responsible for protecting him of herself and the patient from injury in every way possible. Health care workers are often injured while moving and lifting patients, but almost all of these injuries are preventable if the correct body mechanics and rules of safety are used. Patients are also victims of injuries caused by being improperly moved or lifted. Most of these injuries can also be prevented.

Moving patients from the radiographic table to a gurney or wheelchair, or from a hospital bed to a gurney or wheelchair, requires some forethought regarding the safety of the patient as well as to the body mechanics used. Special care with the ancillary equipment must be taken when moving it with a patient during transport. A patient’s integumentary system must be protected from damage. This is of particular concern when the patient is unable to move by his or her own power.

Occasionally, a patient may have to be immobilized for his or her own safety during a radiographic procedure. Not only must the institution-specific rules concerning immobilizers be learned, but also the correct use of these devices must be carefully learned to protect the patient from harm.

The need for a bedpan or urinal may be a requirement that a patient may find embarrassing but unavoidable. As a professional, the radiographer will be able to put the patient at ease and proceed with tact and confidence that will facilitate the procedure to a swift conclusion. The different styles of bedpans require some knowledge as to the correct placement and confidence that will facilitate the procedure to a swift conclusion. The different styles of bedpans require some knowledge as to the correct placement under the patient. An understanding of how a bedpan feels underneath a patient and the embarrassment that the patient experiences will help the radiographer empathize with the patient.

Adhering to rules of radiation safety, preventing and controlling fires, using and disposing of hazardous chemicals correctly, and observing other rules of patient and departmental safety are important parts of the radiographer’s education.

**CARE OF PATIENT’S BELONGINGS**

A patient who comes to the radiology department as an outpatient is frequently required to remove all or some items of clothing and to put on a patient gown before an examination procedure or treatment can be performed. It is usually the radiographer who receives the patient and determines which items of clothing are to be removed. The patient’s discomfort or embarrassment can be decreased if the situation is approached in a courteous and professional manner.

The patient should be taken to the specific dressing area and shown how to close the dressing room door or draw the curtain of the cubicle while undressing. Clearly explain that he or she is to put on the examining gown and point out where to go for the examination once prepared. (Remember that not everyone knows that some types of examining gowns open at the back rather than at the front; this information should be part of the explanation.) Doing this takes only a few moments, and it will make the patient feel more comfortable.

The patient should be given hangers for clothing. If it is permissible to leave clothing in the dressing room, explain this to the patient. If the patient cannot leave the clothing, show him or her what to do with it. Purses, jewelry, and other valuables should be treated with special care so that they will not be lost or stolen.

Many patients wear jewelry or carry a purse or other valuable items to the radiology department. The dressing rooms in most departments are not safe places to leave these items, and the patient may feel justifiably uneasy about leaving them there. Again, consider the patient’s concern and explain what must be done with personal items to keep them safe.

Metal items such as necklaces, rings, and watches are not to be worn for many diagnostic procedures and must be removed before the procedure can begin. An envelope or other container large enough to accommodate all such items should be offered to the patient. Identifying information should be written on a receipt, and all items should be tagged and placed in the designated safety area. This procedure will prevent losses that may result in inconvenience and expense to both the patient and the department.

Do not place value on a patient’s belongings. An item that may seem insignificant to others may be the patient’s most treasured belonging. Every article of clothing or jewelry and the personal effects that a patient brings to the diagnostic imaging department should be treated with care.

**BODY MECHANICS**

Constant abuse of the spine from moving and lifting patients is the leading cause of injury to health care personnel in all health care institutions. Following the correct rules of body mechanics will reduce the amount of fatigue and chance of injury. Rules of body mechanics are based on the laws of gravity.

Gravity is the force that pulls objects toward the center of the earth. Any movement requires an expenditure of energy to overcome the force of gravity. When
an object is balanced, it is firm and stable. If it is off balance, it will fall because of the pull of gravity. The center of gravity is the point at which the mass of any body is centered. When a person is standing, the center of gravity is at the center of the pelvis.

Safe body mechanics require good posture. Good posture means that the body is in alignment with all the parts in balance. This permits the musculoskeletal system (the bones and joints) to work at maximal efficiency with minimal amount of strain on joints, tendons, ligaments, and muscles. Good posture also aids other body systems to work efficiently. For instance, if the chest is held up and out (the musculoskeletal system), then the lungs (the respiratory system) can work at maximal efficiency.

Rules for correct upright posture are as follows:

• Hold chest up and slightly forward with the waist extended. This allows the lungs to expand properly and fill to capacity.
• Hold head erect with the chin held in. This puts the spine in proper alignment, and there is no curve in the neck.
• Stand with the feet parallel and at right angles to the lower legs. The feet should be 4 to 8 inches apart. Keep body weight equally distributed on both feet.
• Keep the knees slightly bent; they act as shock absorbers for the body.
• Keep the buttocks in and the abdomen up and in. This prevents strain on the back and abdominal muscles.

The forces of weight and friction must be overcome when moving and lifting objects. Keep the heaviest part of the object close to the body. If this is not possible, one or more persons should assist with moving or lifting the load.

The force of friction opposes movement. When moving or transferring a patient, reduce friction to the minimum to facilitate movement. This can be done by reducing the surface area to be moved or, in the case of a patient, by using some of the patient’s own strength to assist with the move, if possible. If the patient is unable to assist, reduce friction by placing the patient’s arms across the chest to reduce the surface area. The surface over which the patient must be moved must be dry and smooth. Pulling rather than pushing also reduces friction when moving a heavy object or person. A sliding board or pull sheet placed under an immobile patient also reduces friction. Directions for the use of these items are presented later in this chapter.

To avoid self-injury when moving heavy objects, remember to keep the body’s line of balance closest to the center of the load. Rules for picking up or lifting heavy objects are:

• When picking up an object from the floor, bend the knees and lower the body. Do not bend from the waist (Fig. 3-1)
• The biceps are the strongest arm muscles and are effective when pulling; therefore, pull heavy items or patients rather than push them.
• When assisting a patient to move, balance the weight over both feet. Stand close to the patient, flex the gluteal muscles, and bend the knees to support the load. Use arm and leg muscles to assist in the move.
• Always protect the spine. Rather than twisting the body to move a load, change the foot position instead. Always keep the body balanced over the feet, which should be spread to provide a firm base of support.
• Make certain the floor area is clear of all objects.

CALL OUT!

To prevent lower back injury, always keep the center of gravity, the knees flexed, and the weight over both feet. Do not bend at the waist or twist with the body.

MOVING AND TRANSFERRING PATIENTS

The radiographer may be called upon to transfer or assist in transferring a patient from a hospital room to the diagnostic imaging department. Several precautions must be taken when moving a patient from the hospital room to the imaging department. They are as follows:

1. Establish the correct identity of the patient. Approach the patient and identify yourself and the reason for being there. Ask to see their identification wristband. This is extremely important, as many times the patient has been transferred to another room since the radiology request was submitted.
2. Request pertinent information concerning the patient’s ability to comply with the physical demands of the procedure while at the nurses’ station.
3. Request information concerning the patient’s ability to ambulate and any restriction or precautions to be taken concerning the patient’s mobility.
4. Move the patient to the imaging department according to the necessary restrictions after greeting and identifying him or her and providing an explanation of what is to occur.

CALL OUT!

Never move a patient without enough assistance to prevent injury to yourself and/or the patient.
When the procedure is completed, return the patient to the hospital room using the following procedure:

1. Stop at the appropriate nurses’ station, return the chart, and inform the unit personnel that the patient is being returned to the room. Request help if it is needed at this time.

2. Return the patient to the room, help the patient get into bed, and make him or her comfortable and safe. Place the patient’s bed in the position that is closest to the floor with the side rails raised and the call button within reach in case the patient needs assistance.

**WARNING!**

To prevent possible patient injury, always lower the bed to the lowest position, and secure the rails in the upright position when a patient is returned to bed.

**Assessing the Patient’s Mobility**

Before beginning to move a patient, critical thinking and problem-solving skills must be used to plan the most effective manner of accomplishing the task. The expected outcome of this plan will be to accomplish the move without causing additional pain or injury to the patient. Use interviewing and assessment skills to complete this. Look for the following during patient assessment:

1. **Deviations from correct body alignment.** Deviations in normal physiologic body alignment may result from the following: poor posture, trauma, muscle damage, dysfunction of the nervous system, malnutrition, fatigue, or emotional disturbance. Support blocks or pillows, which are used to assist the patient during the procedure, must be available.

2. **Immobility or limitations in range of joint motion.** Any stiffness, instability, swelling, inflammation, pain, limitation of movement, or atrophy of muscle mass surrounding each joint must be noted and considered in the plan of care.

3. **The ability to walk.** Gait includes rhythm, speed, cadence, and any characteristic of walking that may result in a problem with balance, posture, or independence of movement. Before beginning the move, the amount of assistance needed to safely complete the move and procedure must be planned.
The following rules should be observed during a move:

4. Respiratory, cardiovascular, metabolic, and musculoskeletal problems. Obvious respiratory or cardiovascular symptoms that impair circulation and signal potential problems in positioning must be planned for. Metabolic problems such as diabetes mellitus or rheumatoid arthritis may be discovered during the interview process and planned for as necessary (symptoms and care of patients with medical problems are discussed in Chapter 8).

Other assessment considerations are:

1. The patient's general condition. How well or how poorly is he or she functioning?
2. Range of motion and weight-bearing ability. Has the patient had a surgical procedure that restricts motion or limits weight bearing until it is healed?
3. The patient's strength and endurance. Will the patient become fatigued and be unable to complete the transfer with only stand-by assistance?
4. The patient's ability to maintain balance. Can the patient sit or stand for as long as the procedure requires?
5. The patient's ability to understand what is expected during the transfer. Is he or she responsive and alert?
6. The patient's acceptance of the move. Does the patient fear or resent the transfer? Will the transfer increase the pain? Does the patient feel that the move is unnecessary?
7. The patient's medication history. Has the patient received a sedative, hypnotic, or other psychoactive drug in the past 2 or 3 hours? Will any medication that he or she has taken affect the ability to move safely?

Before going to the patient, a consultation with the nurse in charge of the patient is recommended so that the patient's condition and limitations can be understood. If assistants are needed, they must be on hand. A patient must never be moved without adequate assistance; to do so may cause injury to the patient or the radiographer. The radiographer must decide how the patient can be transferred safely and comfortably, whether by gurney or by wheelchair. Hospital patients are seldom allowed to walk to and from the diagnostic imaging department for reasons of safety. Someone must always be at the patient's side as he or she moves. The following rules should be observed during a move:

1. Give only the assistance that the patient needs for comfort and safety.
2. Always transfer a patient across the shortest distance.
3. Lock all wheels on beds, gurneys, and wheelchairs before the move begins.
4. Generally, it is better to move a patient toward his or her stronger side while assisting on the patient's weaker side.
5. The patient should wear shoes for standing transfers, not slippery socks.
6. Inform the patient of the plan for moving and encourage him or her to help.
7. Give the patient short, simple commands and help the patient to accomplish the move.

Methods of Moving Patients

There are essentially three ways of transferring patients: by gurney, by wheelchair, and by ambulation.

By Gurney

When a patient is moved from a gurney to a radiographic table, or the reverse, great care must be taken to prevent injury. If the patient is unconscious or unable to cooperate in the move, the patient's spine, head, and extremities must be well supported. Convenient and safe ways to do this are by using a sliding board or a sheet to slide the patient from one surface to another.

Sheet Transfer

To place a sheet under a patient, use a heavy draw sheet or a full bed sheet that is folded in half. Have one person stand on each side of the table or bed at the patient's side. Turn the patient onto his or her side toward the distal side of the bed or table. Place the sheet on the table or bed with the fold against the patient's back (Fig. 3-2A). Roll the top half of the sheet as close to the patient's back as possible (Fig. 3-2B). Inform the patient that he or she will be turned onto the side toward the opposite side and will be moving over the rolled sheet. Then turn the patient across the sheet roll and have the assistant straighten the sheet on the distal side (Fig. 3-2C). Return the patient to a supine position, and the transfer may begin.

If the patient is an adult, three or four people should participate in the maneuver. One person stands at the patient's head to guide and support it during the move, with another at the side of the surface to which the patient will be moved, and a third person at the side of the surface on which the patient is lying. If there are four people, two may stand at each side. The sheet is rolled at the side of the patient so that it can easily be grasped, close to the patient's body. In unison (usually on the count of three), the team transfers the patient to the other surface. Extra care over the metal parts of the radiographic table's metal edges should be taken as well as assuring that the tube housing is positioned out of the way.
Sliding Board Transfer

The sliding board (also called a smooth mover and a “smoothie”) is a glossy, plasticized board approximately 5 feet 10 inches in length and about 2 feet 6 inches wide. This item facilitates moving patients from one surface to another, usually from a gurney to an examining table. The sliding board usually requires fewer personnel to make the move than the sheet transfer because it creates a firm bridge between the two surfaces over which the patient can be easily moved. The sliding board transfer procedure is as follows:

1. Obtain the sliding board and spray it with antistatic spray if necessary.
2. Obtain the assistance of one other person if the patient is of average size and weight; if the patient is large, three people may be necessary to move the patient safely.
3. Move the patient to the edge of the gurney. One person should hold the sheet that the patient is laying on over the top of the patient to keep the patient from possibly rolling off the gurney.
4. Move the gurney up against the radiographic table and lock the wheels of the gurney.
5. Assist the patient to turn onto his or her side, away from the radiographic table, and place the sliding board under the sheet upon which the patient was lying.
6. Create a bridge with the board between the edge of the radiographic table and the edge of the gurney (Fig. 3-3A).
7. Place the sheet over the board, and allow the patient to roll back onto the board.
8. With one person at the side of the radiographic table and the other at the side of the gurney, slide the patient over the board and onto the radiographic table (Fig. 3-3B).
9. Assist the patient to roll toward the distal side of the radiographic table, keeping the patient secure by holding onto the sheet on which he or she was lying. The person standing on the side of the gurney should remove the sliding board from under the patient (Fig. 3-3C).
10. Remove the gurney and perform the radiographic procedure.
11. When the procedure is completed, the patient can be transferred back to the gurney by repeating the steps above.

FIGURE 3-2  (A) Place the sheet on the table with the fold against the patient's back. (B) Take the top half of the sheet and roll it against the patient. (C) After the patient is rolled to the opposite side, the rolled half of the sheet is straightened out.
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12. Once the patient is back on the gurney, place a pillow under the patient’s head, if this is permitted, and put the side rails of the gurney up. Place a soft immobilizer over the patient. The patient may then be transferred.

13. When the move is complete, discard the soiled linen that was used on the radiographic table, and clean the sliding board and the table with a disinfectant spray.

14. After washing hands, place clean linen on the table.

CALL OUT!

Always obtain enough assistance to move a patient, even with a smooth mover. This is for the safety of both the patient and the radiographer.

USE OF IMMOBILIZERS

The ethical and legal restrictions concerning use of immobilizers (often called restraints) in patient care are discussed in Chapter 1. The radiographer must remember that immobilizers must be ordered by the physician in charge of the patient’s care and applied in compliance with institutional policy.

The Joint Commission states that immobilizers should be used only after less restrictive measures have been attempted and have proved ineffective in protecting the patient. Remember this and use critical thinking skills to avoid the use of immobilizers if at all possible. Immobilizers are defined as any manual method or physical or mechanical device, material, or equipment attached or adjacent to the person’s body that the person cannot remove easily that restricts freedom of movement or normal access to one’s body (Omnibus Reconciliation Act, 1989).

The most effective method of avoiding the need to restrain an adult patient is the use of therapeutic communication to explore the patient’s fears. If a patient seems fearful or is striking out or moving in an unsafe manner, assure the patient that the procedure will be carried out quickly and in a manner that keeps him or her as comfortable as possible. If this does not reassure the patient, other less restrictive devices, such as soft, Velcro straps (Fig. 3-5A), sandbags (Fig. 3-5B and 3-5C), and sponges may be used to remind the patient to refrain from moving. If immobilizers are to be used, be

FIGURE 3-3  
(A) Create a bridge with the board between the table and the gurney. (B) Roll the sheet close to the patient and slide the patient onto the table. (C) Remove the sliding board while safely securing the patient.
**Wheelchair Transfer**

If a patient must be moved from a bed or radiographic table to a wheelchair, or the reverse, he or she must be helped. Never allow a patient to get off a table or onto a wheelchair without some assistance. The patient is often not as strong as he or she thinks. The sudden movement may cause dizziness, and the patient may fall.

If the patient has been in a supine position and is to be helped to a sitting position, have the patient turn to the side with knees flexed. Then stand in front of the patient with one arm under the shoulder and the other across the knees.

1. If the patient can assist, instruct him or her to push up with the upper arm when told to do so (Fig. 3-4A).
2. On the count of three, move or help the patient to a sitting position at the edge of the table. Before helping the patient to stand, allow him or her to sit for a moment and regain a sense of balance. While the patient is "dangling," place nonskid slippers on the patient’s feet.
3. If the patient needs minimal assistance to get off the table, stand at the patient’s side and take the patient’s arm to help.
4. If the radiographic table is high, never allow a patient to step down without providing a secure stepping stool. Always stay at the patient’s side to assist. A telescoping radiographic table must be placed in the lower position before a patient is assisted to move off of it.
5. The wheelchair must be close enough so that the patient can be seated in the chair with one pivot (Fig. 3-4B). Have the foot supports of the chair up and the wheels locked.

6. The footrests on the wheelchair should then be put down and the wheels unlocked. A safety belt should be put across an unsteady patient.

**CALL OUT!**

When moving a patient from hospital bed to wheelchair, always place nonskid slippers on the patient’s feet, provide assistance to prevent falls, and secure the seatbelt on the wheelchair.

**WARNING!**

Before allowing a patient to get out of a wheelchair, raise the foot supports out of the way. Many patients step on these, causing the wheelchair to flip over, which causes injury to the patient!

Once placed on the radiographic table, cover the patient with a protective sheet. Do not allow the patient to become chilled.

A patient who has received a narcotic, hypnotic, or other type of psychoactive medication; a confused, disoriented, unconscious, or head-injured person; or a child must never be left alone on a radiographic table or gurney. If the patient’s behavior cannot be predicted or if the patient is in a wheelchair; observe him or her carefully. A soft immobilizer belt should be placed over any patient on a gurney or in a wheelchair. The side rails of the gurney must always be up.
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certain that they are being used to protect the patient’s safety and that their use is the only alternative.

There are various types of immobilizing devices that may be used for adult patients. Immobilizers for use with children are discussed in Chapter 10. Reasons for application of immobilizers in the care of an adult patient include the following:

1. To control movement of an extremity when an intravenous infusion or diagnostic catheter is in place
2. To remind a patient who is sedated and having difficulty remembering to remain in a particular position
3. To prevent a patient who is unconscious, delirious, cognitively impaired, or confused from falling from a radiographic table or a gurney; from removing a tube or dressing that may be life sustaining; or from injuring him or herself by impact with diagnostic imaging equipment

When caring for a patient who has been immobilized, explain the reason for using immobilizers to the patient and to anyone who may accompany the patient. After immobilizers are applied, do not leave the patient unattended, and inform the patient that he or she is not alone and is not being punished. Also explain that the immobilizers are only temporary and that as soon as the procedure is finished, the immobilizer will be removed.

A calm, reassuring manner often soothes an agitated or confused patient who has been immobilized. A patient in this state needs repeated orientation as well as a quiet and quick explanation to complete the procedure. Return the patient to the hospital room or wherever he or she is to be taken on completion of the radiographs.

Always apply immobilizers carefully and in the manner prescribed by the manufacturer of the device. The type of immobilizer to be used is dictated by need. As explained in Chapter 1, all radiographers must document application of immobilizers. The following are rules for application of immobilizers:

1. The patient must be allowed as much mobility as is safely possible.
2. The areas of the body where immobilizers are applied must be padded to prevent injury to the skin beneath the device.
3. Normal anatomic position must be maintained.
4. Knots that will not become tighter with movement must be used (a half-knot is recommended; Fig. 3-6).
5. The immobilizer must be easy to remove quickly, if this is necessary.

FIGURE 3-5 (A) A Velcro strap being placed snugly but not tightly. (B) Sandbags will help remind the adult patient to remain still. (C) Sandbags will also assist in immobilizing the infant while holding the shield in place.
6. Neither circulation nor respiration must be impaired by the immobilizer.
7. If leg immobilizers are necessary, wrist immobilizers must also be applied to prevent the patient from either unfastening the device or, in an attempt to leave the radiographic table or gurney, accidentally hanging him or herself.

Although the radiographer is not usually the health care worker who monitors the patient in immobilizers for long periods of time, it should be known that immobilizers may need to be removed and the joints affected by the immobilizer be put through range of motion exercises. Only one immobilizer at a time should be released, and then retied prior to releasing a second immobilizer. Always tie the immobilizer to a stationary object such as the gurney frame or side of the radiographic table (if possible).

There are various types of immobilizers that may be used, including the following:

1. Limb holders or four-point restraints (Fig. 3-7A)
2. Ankle or wrist immobilizers (Fig. 3-7B)
3. Immobilizing vest for keeping a patient in a wheelchair
4. Waist immobilizer, which keeps the patient safe on an examining table or in a bed, but allows the patient to change position (Fig. 3-7C)

![FIGURE 3-6](image1) Following this sequence will result in tying a half-bow knot. The knot will remain secure until the free end is pulled.

![FIGURE 3-7](image2) (A) Limb holders (four-point restraints). (B) Wrist immobilizer. (C) Waist immobilizer.
At times, a patient who is aggressive and delusional may need to have waist as well as four-point immobilizers that are stronger than those shown in Figures 3-7A and B. Immobilizers of this type also have locks. If this type of immobilizer is necessary, one or more security officers must do this. When this type of immobilizer is necessary, the rules of immobilizer application still apply.

**POSITIONING THE PATIENT FOR DIAGNOSTIC IMAGING EXAMINATIONS**

When a patient must spend a long period of time in the diagnostic imaging department, it is the radiographer's duty to assist the patient to maintain his or her body in normal alignment for comfort and to maintain normal physiologic functioning. There are several protective positions that the body may assume or be assisted to assume for comfort. There are also several positions that the patient may be requested to assume to facilitate diagnosis or treatment. These positions are likely to be used in the radiology department for various procedures:

*Supine or dorsal recumbent position:* Patient is flat on the back. The feet and the neck will need to be supported to prevent flexion of the cervical spine. The patient maybe moved down with the head lower than the rest of the body. Patients are occasionally placed in this position during diagnostic imaging procedures and for promotion of venous return in patients with inadequate peripheral perfusion caused by disease (Fig. 3-8G).

*Prone position:* Patient lies face down. A small pillow should support the head to prevent flexion of the cervical spine. The patient maybe moved down on the table so that the feet drop over the edge, or a pillow may be placed under the lower legs at the ankles to prevent footdrop (Fig. 3-8B).

*High Fowler position:* Patient semi-sits with head raised at an angle of 45 to 90 degrees off the table. This position is used for patient in respiratory distress (Fig. 3-8D).

*Semi-Fowler position:* Patient’s head is raised at an angle of 15 to 30 degrees off the table. The arms must be supported to prevent pull on the shoulders, and the feet must be supported to prevent plantar flexion or footdrop. Pillows or blocks under knees must be removed after a brief time (15 to 20 minutes) to prevent circulatory impairment (Fig. 3-8E).

*Sims position:* Patient lies on either left or right side with the forward arm flexed and the posterior arm extended behind the body. The body is inclined slightly forward with the top knee bent sharply and the bottom knee slightly bent. This position is frequently used for diagnostic imaging of the lower bowel as an aid in inserting the enema tip (Fig. 3-8F).

*Trendelenburg position:* The table or bed is inclined with the patient’s head lower than the rest of the body. Patients are occasionally placed in this position during diagnostic imaging procedures and for promotion of venous return in patients with inadequate peripheral perfusion caused by disease (Fig. 3-8G).

Patients in respiratory distress or who have COPD must not be left in a prone, supine, or Sims’ position for more than brief periods of time to avoid becoming increasingly dyspneic.

**ASSISTING THE PATIENT TO DRESS AND UNDRESS**

The patient may arrive in the diagnostic imaging department alone if he or she comes from outside the hospital. The patient may need assistance in removing clothing. This may be necessary if the patient is in a cast or a brace, is very young, or is in too weakened a condition to help him or herself. The patient may have a contracture of an extremity or poor eyesight. Whatever the problem, if the radiographer senses that the patient will have difficulty undressing if left alone, then assistance should be offered and given as needed.

If a trauma patient is brought to the diagnostic imaging department from the emergency unit, removing the clothing in the conventional manner may cause further injury or pain. It may be necessary to cut away garments that interfere with acceptable radiographs; however, clothing must not be cut without the patient’s consent except in extreme emergencies. If the patient is unable to give consent, a family member should do so in writing for protection.

If clothing must be cut off, try to cut into a seam if at all possible. The clothes should not be automatically thrown in the trash. They should be offered to the patient and placed with the patient’s other belongings.

If the patient is very young and is accompanied by a familiar adult, he or she will be more relaxed and cooperative if the adult helps him to dress and undress. Explain to the adult how the child should be dressed.
FIGURE 3-8  (A) Supine position. (B) Lateral position. (C) Prone position. (D) High Fowler position. (E) Semi-Fowler position. (F) Sims position. (G) Trendelenburg position.
for the procedure, arrange a meeting place, and leave them alone.

If a patient with a disability of the lower extremities must have assistance, the clothing should be removed from the top part of the body first.

1. Place a long examining gown on the patient. Instruct him to loosen belt buckles, buttons, or hooks around the waist and slip the trousers over the hips. If the patient cannot do this, reach under the gown and pull the trousers down over the hips.

2. Have the patient sit down. Squat down in front of the patient and gently pull the clothing over the legs and feet to remove it. If the patient is not able to help, call for an assistant.

Some dresses may be removed in the same way. If this method is not practical, however, and the dress must be pulled over the woman’s head, proceed as follows:

1. Place a draw sheet over the patient and then help her to remove her slip and brassiere.

2. Help her to put on an examining gown and then remove the draw sheet.

The following are steps to re-dress a patient with a paralyzed leg, a leg injury, a cast, or a brace:

1. Slide the clothing (pants or skirt) over the feet or legs as far as the hips while the patient is sitting and still wearing an examining gown.

2. Have the patient stand and pull the clothing over the hips if he or she can tolerate it.

3. If the patient is not able to pull the clothing over the hips alone, have an assistant raise the patient off the chair so that you may slip the clothing over the hips and waist.

4. Remove the patient’s arms from the sleeves of the gown. Have the patient hold the gown over his or her chest, and carefully pull the shirt over the head, or put it on one sleeve at a time.

5. When the outside items of clothing are on the patient, remove the gown from under the clothes.

### THE DISABLED PATIENT

If the patient is on a gurney or the radiographic table and the patient’s clothing must be changed, this can most easily be accomplished with the patient in the supine position.

1. Cover the patient with a draw sheet and have an examining gown ready. Explain what is to be done and ask the patient to help if he or she is able. If the patient is paralyzed or unconscious, summon help before beginning the procedure.

2. Remove the clothing from the less affected side first and then remove the clothing from the more affected side and place the clean gown on that side, making sure to keep the patient covered with the draw sheet.

3. Next place the clean gown on the unaffected side and tie the gown at the back, if practical.

4. If the patient is wearing an article of clothing that must be pulled over the head, roll the garment up above the waist. Then remove the garment up above the waist. Next, remove the patient’s arms from the clothing, first from the unaffected side and then from the affected side.

5. Neatly, gently lift the clothing over the patient’s head. One person alone should not attempt to undress a disabled patient; to do so may cause further injury or discomfort.

6. To remove trousers, loosen buckles and buttons and have the patient raise his buttocks as the trousers are slipped over his hips. If the patient is unable to help, have an assistant stand at the opposite side of the table. After the trousers have been loosened, have the assistant pull the patient toward him or her, and then slide the trousers off one side of the hip. Next, draw the patient toward the opposite side and have the assistant slide the trousers off the other hip.

7. Slip the trousers below the knees and off.

8. Fold the clothing and place it in a paper bag on which the patient’s name has been printed. If a relative or a friend accompanies the patient, ask that person to keep the patient’s clothing. If the patient is alone, the radiographer is responsible for caring for the clothing.

When a patient’s gown becomes wet or soiled in the radiology department, it is the duty of the radiographer to change it. If a patient is allowed to remain in a wet or soiled gown, the skin may become damaged, or he or she may become chilled.

When changing the gown of a patient who has an injury or is paralyzed on one side, remove the gown from the unaffected side first. Then, with the patient covered by the soiled gown, place the clean gown first on the affected side and then on the unaffected side. Pull the soiled gown from under the clean one.

Always make sure that the patient is covered during the process.

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**CALL OUT!**

When changing a disabled patient’s gown, allow enough material to work with by removing the unaffected side first or by placing the gown on the affected side first.
THE PATIENT WITH AN INTRAVENOUS INFUSION

Frequently, patients are taken to the diagnostic imaging department with an IV infusion in place.

1. If the patient’s gown must be changed, slip the clothing off the unaffected side first.

2. Carefully slide the sleeve of the unaffected side over the IV tubing and catheter, then over the container of fluid. For this step, the container must be removed from the stand.

3. When replacing the soiled gown with a clean one, first place the sleeve on the affected side over the container of fluid, then over the tubing and onto the arm with the venous catheter in place (Fig. 3-9). Rehang the bottle of fluid and complete the change.

4. When moving the arm of a patient who has an IV catheter in place, support the arm firmly so that the catheter does not become dislodged. Remember to keep the bottle of fluid above the infusion site to prevent blood from flowing into the tubing.

If the intravenous infusion is being controlled by a pump and the patient’s gown becomes wet or soiled and must be changed, do not attempt to disengage the IV tubing from the pump. In this case:

1. Remove the gown from the unaffected arm, and place the soiled gown to one side of the table until the nurse in charge of monitoring the infusion can remove it.

2. Replace the soiled gown with a clean gown over the unaffected side and the chest only.

SKIN CARE

The radiographer is responsible for the care of the patient’s skin or integumentary system while in the diagnostic imaging department. Skin breakdown can occur in a brief period of time (1 to 2 hours) and result in a decubitus ulcer that may take weeks or months to heal. Mechanical factors that may predispose the skin to breakdown are immobility, pressure, and shearing force.

Immobilizing a patient in one position for an extended period of time creates pressure on the skin that bears the patient’s weight. This, in turn, restricts capillary blood flow to that area and can result in tissue necrosis.

Moving a patient to or from a diagnostic imaging table too rapidly or without adequately protecting the patient’s skin may damage the external skin or underlying tissues as they are pulled over each other creating a shearing force. This, too, may lead to tissue necrosis.

Another factor that contributes to skin breakdown is friction caused by movement back and forth on a rough or uneven surface such as a wrinkled bed sheet. Allowing a patient to lie on a damp sheet or remain in a wet gown may lead to skin damage. Similarly, urine and fecal material that remain on the skin act as an irritant and are damaging to the skin.

Early signs that indicate imminent skin breakdown are blanching and a feeling of coldness over pressure areas. This condition is called ischemia. Ischemia is followed by heat and redness in the area as the blood rushes to the traumatized spot in an attempt to provide nourishment to the skin. This process is called reactive hyperemia. If, at the time of reactive hyperemia, the pressure on the threatened area is not relieved, the tissues begin to necrose, and a small ulceration soon becomes visible. Ischemia and reactive hyperemia are difficult to observe in patients who are dark-skinned. In these cases, the skin must be felt to assess any threat of damage. A shearing injury to the skin may cause it to appear bluish and bruised. If such an area is not cared for, necrosis and ulceration will occur.

Persons who are most prone to skin breakdown are the malnourished, the elderly, and the chronically ill. A patient who is elderly and in poor health may have dehydrated skin, an accumulation of fluid in the tissues (edema), increased or decreased skin temperature, or a loss of subcutaneous fat that acts to protect the skin. Any of these factors can contribute to skin breakdown, and the radiographer must be particularly cautious when moving or caring for this type of patient.

Preventing Decubitus Ulcers

Protection of the integumentary system must always be a consideration when caring for patients in the diagnostic imaging department. The tables on which the patients must be placed for care are hard, and often the surface is unprotected. The areas most susceptible to decubitus ulcers are the scapulae, the sacrum, the trochanters, the knees, and the heels of the feet.
The patient who is on the imaging table for a long period of time should be allowed to change position occasionally to keep pressure off the hips, knees, and heels. This can be done by placing a pillow or soft blanket under the patient or by turning him or her to a different position whenever possible. This is done in the usual hospital situation every 2 hours. If the patient is lying on a hard surface, such as the radiographic table, it should be done every 30 minutes. If a patient is perspiring profusely or is incontinent of urine or feces, make certain that he or she is kept clean and dry, and take precautions when moving the patient to prevent skin abrasions.

Special precautions should be taken to protect the patient’s feet and lower legs during a position change or transfer. Shoes should protect the feet, and care should be taken to prevent bruising while the move is made. Circulatory impairment in the lower extremities is common, and the slightest bump may be the beginning of ulceration.

CAST CARE AND TRACTION

Radiographic exposures of fractures that have been casted are often needed to determine correct positioning of musculoskeletal tissues. Casts may be made of plaster, fiberglass, plastic, or cast-tape materials. The material used depends on the type of injury, the length of time needed for immobilization, and the physician’s preference.

The radiographer will often care for the patient who has a newly applied cast. Some of the materials used, particularly plaster, contain water and can accidentally be compressed. Compression of a cast may produce pressure on the patient’s skin under the cast, and this, in turn, may lead to the formation of a decubitus ulcer at the site of cast compression. A cast that becomes too tight may cause circulatory impairment or nerve compression. To prevent these complications, the radiographer must be able to assess the patient for circulatory or neurologic impairment and must learn to move a cast with care.

When moving a patient who is wearing a cast, slide an opened, flattened hand under the cast. Avoid grasping the cast with fingers, since this may cause indentations if the cast material is still damp. A cast must be supported at the joints when it is moved. A casted extremity must be moved as a unit with flat hands supporting it at the joints (Fig. 3-10). When moving a patient who has an abduction bar placed between the legs of a spica cast, it is imperative that the abduction bar not be used as a moving or turning device.

To position a patient who is in a cast, positioning sponges or sandbags must be on hand so that the cast can be well supported. A recently casted limb usually should be kept elevated. If a cast is allowed to put pressure on the skin in any area, it may impede circulation or damage underlying nerves.

A patient with a cast who is in the diagnostic imaging department for any length of time should be assessed for signs of impaired circulation or nerve compression every 15 minutes. A cast applied to an arm may cause a circulatory disturbance in the hand; a leg or body cast may affect circulation in the feet, toes, or lower leg. Signs of impaired circulation or nerve compression that may be easily detected are as follows:

• **Pain**: Sudden pain or pain that increases with passive motion may indicate nerve damage.
• **Coldness**: Fingers or toes distal to a cast should feel warm.
• **Numbness**: A cast that is too tight may cause numbness, another sign of nerve damage.
• **Burning or tingling of fingers or toes**: These symptoms may indicate circulatory impairment.
• **Swelling**: Indicative of edema, swelling may result in circulatory impairment or nerve compression.
• **Skin color changes (to a pale or bluish color)**: Skin should remain pink and warm. In dark-skinned persons, temperature and comparison with the normal extremity are evaluated.
• **Inability to move fingers or toes**: All fingers and toes should be able to be moved and fully extended and flexed.
• Decrease in or absence of pulses: These changes may indicate circulatory impairment.

If the last three changes are observed, the physician should be notified and an attempt to relieve the pressure must be made.

If the patient in a body cast or a spica cast reports difficult respirations or nausea or is vomiting, notify the physician because this may indicate abdominal distress that requires immediate treatment.

Radiographic images of patients who are in traction will require the use of the portable unit. When working with a patient in a traction device, the traction apparatus must never be removed or pulled on. To do so may cause a reduced fracture to become misaligned. Enlist the help of another radiographer or a nurse to obtain the images without endangering the patient’s well-being.

3. After the patient has finished using the lavatory, help him or her to wash hands if unable to do so.

4. Accompany the patient back to the examination area and cover the patient to make him or her comfortable.

5. Return to the lavatory and make certain that it is clean.

6. The radiographer must wash his or her hands.

The Bedpan

The patient who is unable to get to the lavatory must be offered a bedpan or urinal. In the diagnostic imaging department, clean bedpans and urinals are usually stored in a specific place. Most departments stock disposable units.

There are two types of bedpans. The standard bedpan is made of metal or plastic and is approximately 4 inches high. Most patients can use this type. However, a patient may have a fracture or another disability that makes it impossible to use a pan of this height. For these patients, the fracture pan is used. All diagnostic departments should have these pans available (Fig. 3-11).

1. Before assisting the patient, obtain tissue and a bedpan with a towel to cover it. Close the examining room door, or screen the patient to ensure privacy. Always place a sheet over the patient while helping her onto the bedpan. Put on clean, disposable gloves.

2. Approach the patient and place the bedpan at the end of the table. If the patient is able to move, place one hand under the lower back and ask the patient to raise the hips.

3. Place the pan under the hips (Fig. 3-12). Be sure the patient is covered with a sheet. If the patient is unable to sit up, assist the patient to a sitting
**FIGURE 3-12** Place one hand under the patient’s lower back, and ask the patient to raise the hips so that the bedpan may be placed under the patient.

position. Do not leave a patient sitting on a bedpan—he or she is poorly balanced and may fall.

4. Place the toilet tissue where the patient can reach it. Let the patient be alone as much as possible by turning around and facing away from the patient, or if the patient is able to sit by him or herself, step away from the patient to provide privacy.

5. When the patient has finished using the bedpan, put on clean, disposable gloves and help the patient off the pan. Have the patient lie back, place one hand under the lumbar spine and have the patient raise the hips.

6. Remove the pan, cover it, and empty it in the lavatory. Rinse it with clean cold water (dump the water into the toilet, not the sink) and then discard the disposable bedpan in the trash receptacle.

7. Offer the patient a wet paper towel or washcloth to wash the hands and a dry towel to dry them.

8. The radiographer must then remove his or her gloves as described in Chapter 4 and wash the hands thoroughly.

If a patient is unable to assist in getting onto and off a bedpan, do not attempt to help him or her alone. Enlist the aid of another team member. Have that person stand at the opposite side of the table. With the assistance of the second radiographer, turn the patient to a side-lying position. Place the pan against the patient’s hips, then turn the patient back to a supine position while holding the pan in place. Be certain that the hips are in good alignment on the pan. Place pillows under the patient’s shoulders and head and stay nearby. When the patient has finished using the pan, put on clean gloves and reverse the procedure to remove the pan. Be sure to secure the pan before rolling the patient as it will tip and spill the contents as the patient rolls to the side.

If the patient is not able to clean the perineal area, the radiographer will have to do this. Wear clean disposable gloves.

1. Take several thicknesses of tissue and fold them into a pad. Wipe the patient’s perineum from front to back and drop the tissue into the pan. If necessary, repeat the procedure until the perineum is clean and dry.

2. Cover the pan to take it to the bathroom and empty it. If the bedpan is disposable, and the patient will not be staying in the department long enough to use it a second time, the pan may be discarded.

3. Remove the gloves and wash hands correctly.

If a patient has difficulty in moving or adjusting to the height of a regular bedpan, follow the procedure using the fracture pan. The end with the lip is the back of the pan and goes under the patient’s buttocks.

**The Male Urinal**

The male urinal is made of plastic and is shaped so it can be used by a patient who is supine, lying on the right or left side, or in Fowler position. The urinal may be offered to the male patient who is unable to get off of the gurney or examining table to go to the lavatory.

1. If the patient is able to help himself, simply hand him an aseptic urinal and allow him to use it, providing privacy whenever possible.

2. When he has finished, put on clean, disposable gloves, remove the urinal, empty it, and rinse it with cold water. If the urinal is disposable and the patient will not be staying in the diagnostic imaging department long enough to use the urinal a second time, the urinal may be discarded.

3. Offer the patient a washcloth with which to cleanse his hands.

4. Remove the clean glove and wash hands.

If a patient is unable to assist himself in using the urinal, the radiographer must position the urinal for him.

1. Put on clean, disposable gloves; raise the cover sheet sufficiently to permit adequate visibility, but do not expose the patient unduly.

2. Spread the patient’s legs and put the urinal between them.
3. Put the penis into the urinal far enough so that it does not slip out, and hold the urinal in place by the handle until the patient finishes voiding.

4. Remove the urinal, empty it, discard it, remove the gloves, and wash the hands.

DEPARTMENTAL SAFETY

Prevention of patient and personnel injury is the responsibility of all health care workers. It is the responsibility of the radiographer to practice safety in all aspects of work. This includes fire and electrical safety, prevention of patient or staff falls, prevention of poisoning, and safe disposal of hazardous waste and toxic chemicals.

Institutional, local, state, and federal agencies regulate safety in health care institutions, and there are safety committees in all JCAHO-accredited health care agencies. Fire departments in all cities routinely evaluate the fire safety of health care and community institutions. Poison control centers advise health care institutions if poisoning is possible. The Nuclear Regulatory Commission enforces radiation safety and nuclear medicine standards, and the Environmental Protection Agency establishes guidelines for the disposal of radioactive waste.

Fire Safety

The radiographer has an obligation to learn the fire containment guidelines in any institution in which he or she is employed. The following are essential:

1. The telephone number of the institution for reporting a fire; the number must be posted in a clearly visible location next to the telephone
2. The agency’s fire drill and fire evacuation plan
3. The location of the fire alarms
4. The routes of evacuation in case of fire
5. The locations of fire extinguishers and the correct type of extinguisher for each type of fire

- **Carbon dioxide extinguisher:** grease or electrical fire
- **Soda and acid water extinguisher:** paper and wood fire
- **Dry chemical extinguisher:** rubbish or wood fire
- **Antifreeze or water:** rubbish, wood, grease, or anesthetic fire

6. A fire must be reported before an attempt is made to extinguish it, regardless of the size.
7. Hallways must be kept free of unnecessary equipment and furniture.
8. Fire hoses must be kept clear at all times.
9. Fire extinguishers must be inspected at regular intervals. Fire drills must be regularly scheduled for agency personnel.
10. Warning signs must be posted stating that, in case of fire, elevators are not to be used and stairways must be used instead.

If fire occurs, the correct procedure for patient safety must be followed:

1. Persons in imminent danger are to be moved out of the area first.
2. Windows and doors are to be closed.
3. If oxygen is in use, it must be turned off.
4. Patient and staff evacuation procedures must be followed.

General rules for the prevention of accidents involving electrical equipment should include the following:

1. Use only grounded electrical plugs (three pronged) inserted into a ground outlet.
2. Do not use electrical equipment when hands or feet are wet or when standing in water because water conducts electricity.
3. When removing an electrical plug from an outlet, grasp the plug at its base. Do not pull on the electrical cord.
4. Electrical cords must be unkinked and unfrayed; if they are kinked or frayed, don’t use them.
5. Any electrical equipment must be in sound working order to be used for patient care. If it is not, the equipment must be returned to the manufacturer or to the area designated for repair service.
6. All electrical equipment must be tested before it is used for patient care.
7. Report any shock experienced; do not use equipment if a patient reports that it gives a tingling feeling or a shock.
8. Do not use a piece of electrical equipment that has not been explained.
9. To prevent falls, do not use extension cords that are not rounded and secured to the floor with electric tape.

Prevention of Falls

Patient falls are one of the most common hospital accidents. The radiographer must always be on guard to prevent falls. No patients should be allowed to get out of a wheelchair or off a gurney or radiographic table without assistance from the radiographer or designee.

The patients most prone to falls are the frail elderly, persons with neurologic defects, persons who are weak and debilitated due to prolonged illness or lengthy preparations for procedures, persons with head trauma, persons with sensory deprivations, persons who have been medicated with sedating or psychoactive drugs,
and confused patients. Adhere to the following rules to prevent falls:

1. Learn the condition of the patient and determine whether he or she is safely able to enter, remain in, or leave the diagnostic imaging department without assistance.
2. Keep floors clear of objects that may obstruct pathways.
3. Keep equipment such as gurneys, portable radiographic machines, and wheelchairs in areas where they do not obstruct passageways.
4. Side rails must always be up when a patient is on a gurney.
5. A wheelchair must be locked if a patient is in it; a soft restraint may be needed if the patient is not reliable and may try to get up without assistance.

Poisoning and Disposition of Hazardous Waste Materials

The number of the nearest Poison Control Center must be posted near department telephones. As the radiographer, the following must be adhered to:

1. Any toxic chemical or agent that may poison patients or staff must be clearly labeled as such.
2. These substances must be stored in a safe area as designated.
3. Emergency instructions to be followed in case of poisoning must be conspicuously posted in the diagnostic imaging department.
4. Chemicals must remain in their own containers and marked as toxic substances.
5. Chemical and toxic substances must be disposed of according to federal mandates and institutional policy.
6. Restrictions for disposal of hazardous materials must be posted in a conspicuous area and followed by all in the department.
7. Contrast agents and other drugs must be kept in a safe storage area where access to them is not available to anyone not designated to use them.
8. All containers of hazardous substances must be clearly marked with the name of the substance, a hazard warning, and the name and address of the manufacturer.
9. Hazardous substances may be labeled with a color code that designates the hazard category, for instance health, flammability, or reactivity.

The radiographer must read and fully understand all hazard warnings before using any product, and follow the guidelines as stated on the label. If there is no label, or if the label is unclear, the product should not be used.

If an accidental spill of a hazardous substance occurs, first aid guidelines are as follows:

- **Eye contact.** Flush eyes with water for 15 minutes or until irritation subsides. Consult a physician immediately.
- **Skin contact.** Remove any affected clothing; wash skin thoroughly with gentle soap and water.
- **Inhalation.** Remove from exposure; if breathing has stopped, begin CPR; call emergency number and a physician.
- **Ingestion.** Do not induce vomiting; call emergency number and Poison Control Center.

Diagnostic imaging personnel must understand the potential hazards of scalds or burns that may occur in their department. Although the radiographer does not commonly deal with heating pads and hydrotherapy, they do present potential hazards and must be handled safely.

Hot beverages must be kept away from children. Coffee and tea equipment used in staff lounges must be kept in safe working order and deactivated when empty or not in use. If a patient is offered a hot beverage, it should be at a temperature that will not scald him or her if it is accidentally spilled.

Radiation Safety

It is the responsibility of a radiographer to protect patients and personnel from radiation exposure. While the benefit of rapid medical diagnosis by exposure of the patient to radiation outweighs the associated risks, radiation exposure must be kept to a consistently low level.

Ionizing radiation in excessive amounts or in amounts higher than the accepted level in a brief time period can result in either illness to the recipient or a potential genetic disturbance to the descendants of the recipient. Other factors that can increase the risk of suffering the adverse effects of ionizing radiation are the patient’s age at exposure, sensitivity of exposed cells, and the size and area of the body exposed. The very young, the very old, and pregnant women are the most vulnerable to adverse effects of radiation.

The goal of the radiographer must be to limit the amount of ionizing radiation acceptable limits in the patient, others in the vicinity, and personnel. To do this, the following precautions must be taken:

1. Maintain exposure to a level as low as reasonably achievable (ALARA).
2. Minimize the length of time the patient or others in the vicinity are placed in the path of the x-ray beam.
3. Maximize the distance between the source of the ionizing radiation and the person exposed to it.
4. Maximize the shielding from exposure of the patient and others in the vicinity of the radiation.
Time. Use the shortest exposure time possible. Remember that radiation dosage increases with fluoroscopic imaging.

Distance. The closer a person is to the radiation beam, the greater the exposure. The larger the field of radiation, the greater the risks of scattering the ionizing radiation and the greater the exposure risk. Increasing distance from the source greatly reduces the exposure risk of the radiographer and others in the vicinity.

Shielding. Shielding persons who are unable to reduce their exposure either by limiting time or increasing distance is the third alternative for protection from ionizing radiation. Shielding is done by setting up a protective barrier, usually lead or an equivalent, between the source of the ionizing radiation and the subject involved, whether the patient or others in the vicinity. There are primary and secondary barriers. Primary barriers are usually made of lead or similar material; they are designed to withstand being struck by the beam exiting the x-ray tube without allowing passage of ionizing radiation. Secondary barriers are designed to prevent passage of scatter and leakage, rather than direct, radiation.

The radiographer’s obligation is to ascertain that all persons who are involved in or in the vicinity of a radiographic procedure are provided with appropriate protective apparel to shield them from ionizing radiation. This includes the patient, the physician, nurses, observers, and radiographer. Shielding can include a lead apron, lead gloves, a gonadal shield, a thyroid shield, and lead goggles (Fig. 3-13).

Use of gonadal shielding to protect male and female reproductive organs (ovaries and testes) is of vital importance. This is of particular importance when the patient is a child or an adult of childbearing age. There are several types of gonadal shields, including flat and molded contact shields.

The radiographer must use his or her technical expertise to minimize patient exposure to radiation. This includes beam limitation, technique selection, filtration, intensifying screens, and grids. Explanations of these techniques are beyond the scope of this text; their use is discussed in detail in other radiologic technology courses.

The radiographer has the responsibility to understand the technical aspects of the profession so that the number of repeat radiographs necessary to achieve the diagnostic purpose is minimized. The need to frequently repeat exposures should be cause to put critical thinking skills to work to assess and solve the problems that are being encountered. Assess communication with the patient as well as the skills necessary to properly position the patient and set the proper technical factors to achieve a diagnostic radiograph on the first attempt.

Estimates of patient exposure to ionizing radiation must be made available in the radiographic imaging department. These estimates denote the amount of radiation an average patient undergoing a given procedure would expect based on standard technique charts. The amount of exposure actually received is less than compared with these estimates. All radiographic imaging equipment must also be inspected for radiation safety at regularly scheduled times.

Lead aprons and other protective apparel must be inspected periodically for quality control purposes. This apparel must be hung carefully over a wide bar or on special hangers when not in use. To fold or drop them may jeopardize their integrity.

The radiographer and any health care worker who works in constant contact with ionizing radiation must be monitored to assess the amount of exposure to it. This may be done by wearing a radiation-monitoring badge sensitive to low radiation doses. A specialized company processes the badge on a monthly or quarterly basis. The results are then returned to the institution and must be made available to all occupational persons who wear the badge.

Special precautions must be taken to prevent exposing pregnant patients and pregnant health care workers.
workers to ionizing radiation. This is particularly true during the early weeks of pregnancy, when particular fetal tissues are especially sensitive to radiation. This is why it is critical to ask the female patient if there is any possibility of her being pregnant and also when her last menstrual period was. Pregnant workers who “declare” themselves to be pregnant are double badged, and rotations in the department are varied so as to limit the amount of exposure to radiation. The occupational dose limit for a fetus must not exceed 0.5 rem during the entire gestation. The exposure must be limited to no more than 0.05 rems in any month.

To minimize radiation exposure, the radiographer should not hold the patient during a procedure on a routine basis. Sand bags and positioning sponges should be used if possible. If this is not feasible, then a relative or a person who is not working regularly in radiography should be requested to assist.

**SUMMARY**

When an outpatient arrives in the diagnostic imaging department, it is often necessary for that patient to undress entirely or partially for the diagnostic examination or treatment. Always show the patient where and how to do so in a sensitive manner to spare the patient embarrassment.

It is the responsibility of the radiographer to provide the patient with a safe place for personal belongings. Remember that the patient may treasure an article of clothing or jewelry that may not seem valuable. Everything that belongs to the patient must be treated as if it were of value.

Correct body mechanics must always be used. When moving or lifting in the workplace, keep the weight close to the body and maintain a firm base of body support. This is accomplished by having the feet slightly spread out and knees flexed. Twist or bend the body at the waist when lifting a heavy load. Weight should be pulled, not pushed. Use arm and leg muscles, not the spine for lifting.

The three ways of moving patients are by gurney, by wheelchair, or by ambulation. When moving and lifting patients, assess the patient and resolve potential problems before beginning the transfer. The plan for moving the patient should be explained, and the patient’s help should be enlisted before beginning. Always notify the ward personnel when taking a patient to or from his or her hospital room. The use of enough assistants and ward personnel when taking a patient to or from his or her hospital room. The use of enough assistants and ward personnel when taking a patient to or from his or her hospital room.

The three ways of moving patients are by gurney, by wheelchair, or by ambulation. When moving and lifting patients, assess the patient and resolve potential problems before beginning the transfer. The plan for moving the patient should be explained, and the patient’s help should be enlisted before beginning. Always notify the ward personnel when taking a patient to or from his or her hospital room. The use of enough assistants and ward personnel when taking a patient to or from his or her hospital room.

When a patient is on the radiographic table or on a gurney in the diagnostic imaging department, his or her body must be in good alignment. If the patient is moved to a particular position for an examination, restore correct body alignment as soon as possible.

There are times when immobilizers must be used for the safety of the adult patient. When immobilizers are required, apply them according to the manufacturer’s directions and the policy of the institution. Do not immobilize a patient without an order by a physician. When a patient is immobilized, attend to him or her at all times and release the immobilizers at least every 2 hours. Follow the correct manner of documenting immobilization use.

Take care to prevent the patient’s skin from being damaged while being cared for in the diagnostic imaging department. This can be done by preventing injury that may come from immobility, pressure, shearing force, or friction. Patients most susceptible to skin breakdown are the malnourished, the elderly, and the chronically ill. Take special care to protect these patients from injuries to their integumentary system, because they may result in a decubitus ulcer that can take months to heal. Also, take extra precautions when caring for a patient who is wearing a cast or who is in traction. Observe the patient’s extremities for evidence of neurocirculatory impairment, which may result from the pressure of a cast on the skin. Some symptoms of neurocirculatory impairment that are easily detected are pain, coldness, numbness, burning or tingling of fingers or toes, swelling, color changes of the skin, and an inability to move fingers or toes. If these symptoms are noted, change the patient’s position and report the problem to the physician immediately. Do not release a traction apparatus while taking a radiographic image. If the procedure cannot be completed because of the traction bar, request assistance from the nurse in charge of the patient.

If a patient is unable to undress alone, offer assistance. Give assistance in a matter-of-fact manner that does not violate the patient’s privacy. Patients must be kept clean and dry while in the diagnostic imaging department. It is the radiographer’s duty to change the disabled patient’s gown and covering if they become wet or soiled. Do this in a prescribed manner to ensure privacy, safety, and comfort.

Some examinations in the imaging department are long and tedious. They often stimulate peristalsis and a need to defecate or urinate. Meeting these needs cannot be postponed. Be prepared to assist with either the bedpan or urinal if necessary and do it in a way that ensures the patient as much privacy as possible. Infection control measures must be taken when assisting a patient with a bedpan or urinal. These items must be
used for one patient only and then disposed of in the proper waste receptacle. Put on clean, disposable gloves when assisting with the patient’s elimination needs and wash thoroughly after removing the gloves. The patient must not be left unattended while on a bedpan, gurney, or diagnostic imaging table. Patients must never be allowed to get on or off an examining table or out of a wheelchair without assistance. They must also be carefully attended on trips to the lavatory and in a dressing area after an examination or treatment.

The radiographer must be constantly on guard to protect patients and other staff members from accidents in hospitals. Most falls and injuries to patients can be prevented if the radiographer is knowledgeable about the patient’s condition and comfort. The radiographer must understand the precautions to take routinely to prevent fire and the correct procedures to follow if a fire occurs. Prevention of accidents due to faulty electrical equipment or poisoning and the correct use and disposal of hazardous materials are also the radiographer’s professional obligation.

Unnecessary exposure to radiation to the patient and personnel is the responsibility of the radiographer. Excessive amounts of radiation from improper technical factors or from repeat exposures have an adverse effect on living tissue. The very young, the very old, and pregnant women are particularly susceptible to adverse affects of ionizing radiation. Precautions to prevent excessive exposure involve knowledge, technical expertise, and constant vigilance.

**CHAPTER 3 TEST**

1. When admitting a patient to the diagnostic imaging department, what should be done? (Circle all that apply)
   a. Take the patient to the dressing area and explain in some detail how he or she should dress for the procedure.
   b. Give the patient directions concerning how to care for valuables brought to the department.
   c. Assist any patient who appears to need assistance with preparation for an examination.

2. The most effective means of reducing friction when moving a patient is by:
   a. Placing the patient’s arms across the chest and using a pull sheet
   b. Pushing rather than pulling the patient
   c. Rolling the patient to a prone position
   d. Asking the patient to cooperate

3. When transporting a patient back to the hospital room, some safety measures to be used are (circle all that apply):
   a. Place the side rails up, the bed in “low” position, and the call bell at hand.
   b. Inform the nurse in charge of the patient that the patient has been returned to the room.
   c. Give the patient something to eat or drink.
   d. Be sure that the TV is in place for the patient’s viewing.

4. Which procedures must be observed when assisting a patient with a bedpan (circle all that apply):
   a. Respect the patient’s privacy.
   b. Seek assistance for an immobile patient.
   c. Wear clean gloves to remove the bedpan.
   d. Make sure to offer tissue to the patient and a towel to clean his or her hands.

5. Contributing factors to skin breakdown are (circle all that apply):
   a. Turning the patient every 1 to 2 hours
   b. Friction and pressure
   c. Frequent diagnostic imaging procedures
   d. A wet environment

6. If a patient who has a cast in place complains of pain that is sudden in onset and increases in intensity when the affected limb is moved, what should be done? (Circle all that apply)
   a. Complete the procedure and discharge the patient.
   b. Elevate the affected limb.
   c. Notify a physician immediately.
   d. Find a nurse to administer pain medication.

7. When caring for a patient who has a new cast applied to an extremity, what must be remembered? (Circle all that apply)
   a. Hold the cast firmly at a position between the joints when moving it.
   b. Observe for signs of impaired circulation.
   c. Support the cast with bolsters and sandbags where needed.
   d. The extremity is now almost impervious to pain and can be twisted as needed for the image.

8. When caring for a patient who is disabled and is difficult to move, it is best to:
   a. Keep the patient as quiet as possible.
   b. Work quickly.
   c. Obtain as much help as necessary to avoid injury to the patient and to the radiographer.
   d. Move the patient by gurney.

9. When moving a heavy object, you should _______ the weight, not __________ it.

10. Patients most prone to falls are (circle all that apply):
   a. The frail elderly
   b. The person who is confused
c. Persons who have been given a psychoactive drug
d. Persons with sensory deficits

11. When moving a patient into an unnatural position for a radiographic examination, the patient should maintain that position:
   a. Until he or she asks to be moved
   b. Until the radiograph has been processed and approved by the radiologist
   c. Only for the time it takes to make the exposure

12. Match the following:
   a. Fowler position  i. Patient on side with forward arm flexed and top knee flexed
   b. Supine position  ii. Semi-sitting position with head raised 45 to 60 degrees
   c. Semi-Fowler position iii. Patient laying flat on back
   d. Trendelenburg position  iv. Patient on back with head lower than extremities
   e. Sims position  v. Patient on back with head raised 15 to 30 degrees

13. Name the two convenient and safe methods of moving a patient from a radiographic table to a gurney.

14. Describe three legitimate reasons for application of immobilizers to an adult patient.

15. List four signs of circulatory impairment if a patient is wearing a cast.

16. What are three methods of reducing a patient’s exposure to ionizing radiation?

17. The leading cause of work-related injuries in the field of health care is:
   a. Bumping into misplaced equipment
   b. Overexposure to radiation
   c. Infection owing to poor hand-washing techniques
   d. Abuse of the spine when moving and lifting patients