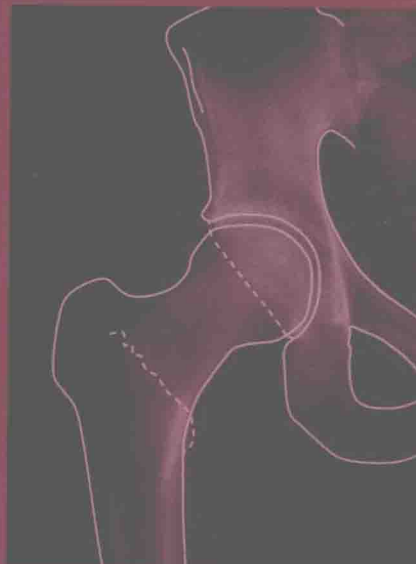
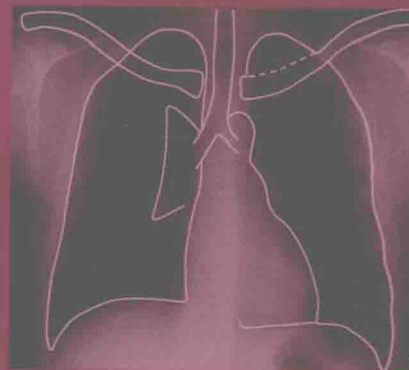
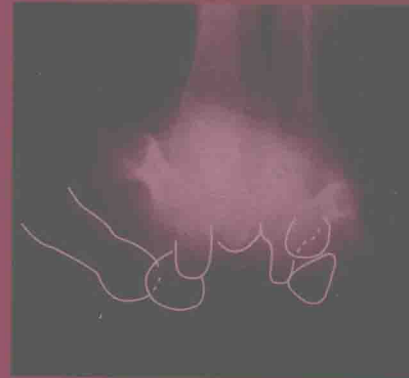


*R*ADIOGRAPHIC
ANATOMY
POSITIONING

Andrea Gauthier Cornuelle

COMPETENCY MANUAL FOR



**COMPETENCY
MANUAL FOR**

RADIOGRAPHIC
ANATOMY
POSITIONING

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*To the students who have used this manual
and offered suggestions for improvement, and
to my family for their never-ending support.*

PREFACE



This *Competency Manual* was developed to give simple step-by-step instructions for performing radiographic positioning. It was also designed as an evaluative tool for use in a laboratory or clinical setting. Various radiographic positioning texts were used as resources during the *Manual's* development. This *Manual* is not meant to be a comprehensive guide to all radiographic positioning. It includes descriptions of projections most commonly performed.

Each projection is divided into discrete tasks that must be performed for accurate patient positioning. Each **task analysis** has an introductory section that includes the projection name, student's objective, basic patient preparation, cassette type, film size, and orientation. The procedural portion of the task analysis includes special informational notes as well as identification of anatomy that should be demonstrated on the finished radiograph (Critical Anatomy) if the patient is correctly positioned. Space is included on each task analysis to indicate satisfactory and unsatisfactory performance when this manual is used for eval-

uation purposes. Drawings have been included with each task analysis to illustrate patient position, film placement, and central ray location. Although cassette sizes are stated in inches, metric conversions are included in chapter 1.

The *Competency Manual* can be used with or without the checklist to evaluate student performance. The *Manual* may also be used as a quick reference for the technologists and students or as a procedural manual within a department. Space is found at the end of each projection for notes.

A tremendous amount of time and energy have gone into the production of this *Manual*. As with any project of this magnitude, editing and revision are on-going processes. Constructive comments and suggestions would be accepted gratefully. The author hopes this *Manual* will be beneficial to the student and technologist, not only for instruction and evaluation, but also as a reference.

Andrea Gauthier Cornuelle

ACKNOWLEDGMENTS



In one form or another, this *Competency Manual* has been in existence for over 12 years. I owe special thanks to Carlos Soto, my first program director, who asked me to create a manual that could be used to document laboratory competence, and to Katherine C. Rosenthal for collaborating with me on the first edition. My colleague, Diane Gronefeld, graciously agreed to review content during the first major revision stage seven years ago and has continued to offer suggestions for improvement since that time.

I want to recognize and thank Kathy Stewart and Beth Merten for the many hours they spent developing the art for this manual. The work was time consuming as they toiled to produce drawings that accurately illustrate each patient position.

Last, my family deserves more thanks than I can possibly express. They have been patient and supportive throughout the entire process.

A.G.C.

CONTENTS



| | | | |
|--|-----|--|-----|
| <i>Preface</i> | vii | 9. Bony Thorax | 161 |
| 1. Introduction to Radiographic Positioning..... | 1 | 10. Vertebral Column | 173 |
| 2. Respiratory System..... | 7 | 11. Skull | 207 |
| 3. Abdomen..... | 19 | 12. Facial Bones & Paranasal Sinuses | 229 |
| 4. Introduction to Musculoskeletal System..... | 27 | 13. Introduction to Contrast Studies | 265 |
| 5. Upper Limb (Extremity)..... | 31 | 14. Urinary System | 267 |
| 6. Shoulder Girdle..... | 75 | 15. Digestive System | 279 |
| 7. Lower Limb (Extremity)..... | 95 | 16. Biliary System..... | 307 |
| 8. Pelvic Girdle | 143 | | |

INTRODUCTION TO RADIOGRAPHIC POSITIONING

This manual was developed to provide students and practicing radiographers with step-by-step guidelines necessary to position patients accurately for radiographic examinations. When following these guidelines, however, it is important to remember that they are just that—guidelines. There is often more than one way to achieve the desired outcome. No single guideline can apply to all patients in all situations.

This manual should be used as a practical tool, but, as with all tools, the user must use common sense and think through all situations, deciding when it is necessary to vary from a standard guideline. For example, when centering a patient for a KUB (kidneys, ureters, and bladder) examination, the standard guideline is to center the central ray to the level of the iliac crests. With many male patients, however, the symphysis pubis and part of the bladder area would be missed if the central ray were not directed inferior to the iliac crests. On this same patient, the radiographer may have to center above the iliac crests to include the kidneys on the radiograph. In addition, positioning protocols vary from one department to another. The radiographer must follow protocol as stated in the department's policy and procedure manual. It is, therefore, important to always double-check your work and make adjustments in centering and positioning as necessary.

► PROCEDURAL CONSIDERATIONS

Patient Care

Communication with the patient is a vitally important part of the radiographer's job. Because radiographic examinations are usually fairly brief, the radiographer must quickly establish a good rapport with the patient. Most often, the first contact the radiographer has with the patient is in the waiting room when the patient's name is called. After the radiographer correctly identifies the patient, the patient may be instructed to enter a dressing booth to change into a patient gown. Instructions should be thorough and clear. It is also important to remember that the patient may be feeling a loss of privacy and feel somewhat embarrassed by the new attire, especially if it is too short, too small, or open in the back. Help the patient feel comfortable.

A thorough patient history relevant to the requested examination is important for all radiographic examinations. This information should be conveyed to the radiologist who will interpret the films. Patient histories should be specific. Stating that the patient is experiencing pain at the base of the 5th metatarsal could change an interpretation from "probably normal" to "possible fracture" when the radiologist sees something that could be a normal variant. Stating

that the patient "fell" may not provide adequate information and could result in an inaccurate interpretation of the study.

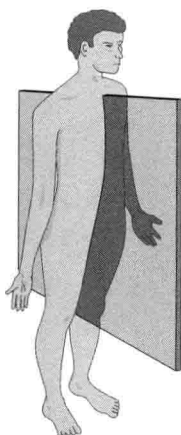
The radiographer is also responsible for providing procedural information before, during, and after the examination. When the patient understands what is expected, he or she is more likely to cooperate fully, leading to better-quality radiographs.

Last, while the radiographer may remember few details about the patients or procedures performed in a given week, the patients *will* remember many details about the radiographer and the care received. Good impressions count!

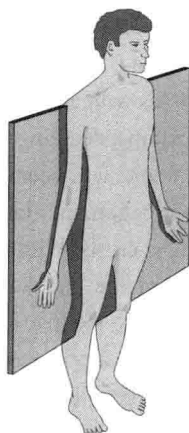
Positioning Terminology

Projection is a term used to describe the direction of the central ray as it passes through the body. An *AP projection*, therefore, is one in which the central ray enters the anterior aspect of the body and exits at the posterior aspect. The term *position* is used to describe the actual position in which the patient is placed. To accurately position a patient for a radiographic projection, the radiographer must be familiar with various terms. Anatomical planes, directional terms, and positioning terms used throughout this text are summarized in Tables 1–1 to 1–3.

TABLE 1–1. Anatomical Planes



Midsagittal plane



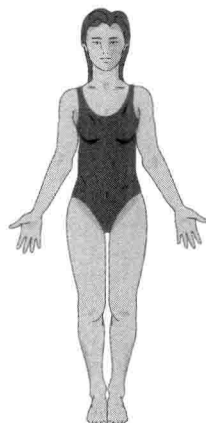
Midcoronal (frontal) plane

Sagittal Plane: Any plane dividing the body into right and left sides; the **midsagittal plane** divides the body into *equal* right and left sides.

Coronal Plane: Any plane dividing the body into anterior and posterior parts; the **midcoronal plane** divides the body into *equal* front and back parts.

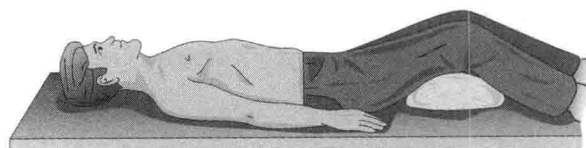
Midaxillary Plane: A coronal plane that passes through the axilla at the junction of the arm and thorax when the arms are at a 90° angle with the body. Although this term is often used synonymously with midcoronal plane, they are not necessarily the same.

TABLE 1–2. Positioning Terminology



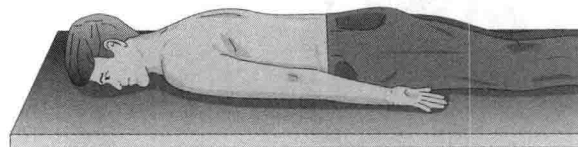
Anatomical position

Anatomical Position: The standing, erect position of the body with all anterior surfaces facing forward; the arms are down with palms forward.



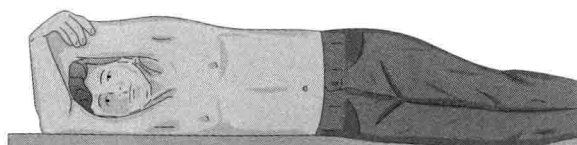
Supine (dorsal recumbent) position.

Supine: Lying flat on the back.



Prone (ventral recumbent) position.

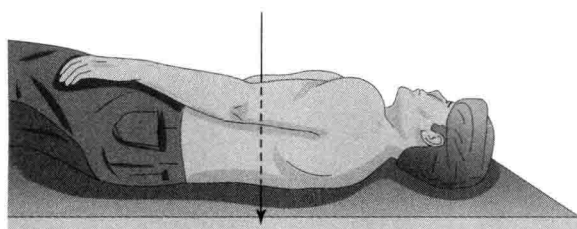
Prone: Lying face down.



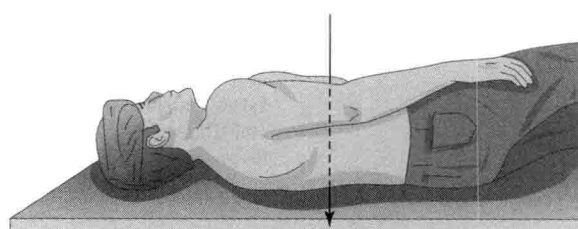
Right lateral recumbent position.

Lateral: Erect or recumbent position, 90° from true AP or PA.

Oblique: The patient is rotated between lateral and prone or supine position; the amount of obliquity may vary depending on the structure to be demonstrated.



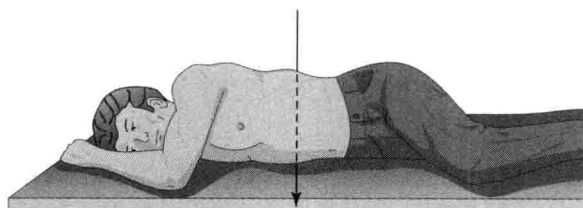
RPO (right posterior oblique) position; AP oblique projection.



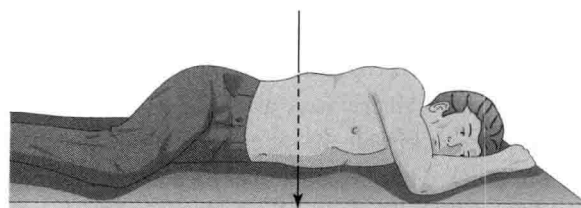
LPO (left posterior oblique) position; AP oblique projection.

Right Posterior Oblique Position: The right posterior side of the patient is nearest the film; the reverse of left anterior oblique.

Left Posterior Oblique Position: The left posterior side of the body is nearest the film; the reverse of right anterior oblique.



RAO (right anterior oblique) position; PA oblique projection.



LAO (left anterior oblique) position; PA oblique projection.

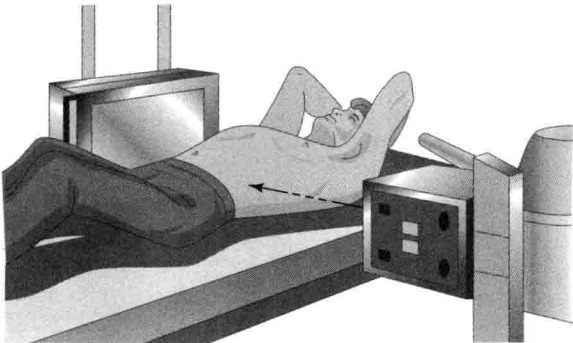
Right Anterior Oblique Position: The right anterior side of the body is nearest the film; the reverse of left posterior oblique.

Left Anterior Oblique Position: The left anterior side of the body is nearest the film; the reverse of right posterior oblique.

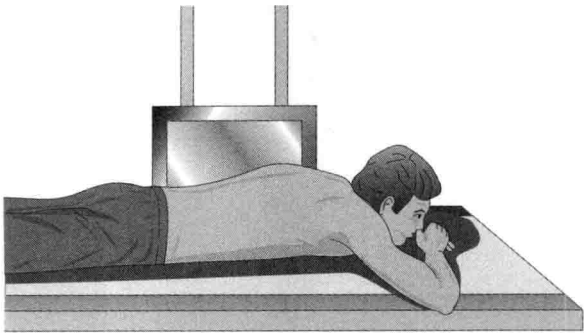
continued

TABLE 1–2. Positioning Terminology (continued)

Decubitus Position: The patient is recumbent; in radiography, usually implies the use of a horizontal beam; used to identify air–fluid levels or free air in a body cavity.



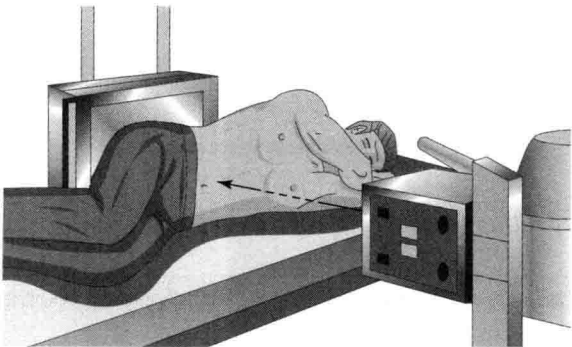
Dorsal decubitus position; lateral projection.



Ventral decubitus position; lateral projection.

Dorsal Decubitus: The patient is supine with the central ray passing horizontally from one side to the other.

Ventral Decubitus: The patient is prone with the central ray passing horizontally from one side to the other.



Left lateral decubitus position; AP projection.

Lateral Decubitus: The patient is lying on either the right or left side; the central ray travels horizontally either from front to back or back to front; when the patient is lying on the left side, it is termed a **left lateral decubitus**.

From Cornuelle AG, Gronefeld DH. Radiographic Anatomy & Positioning: An Integrated Approach. Stamford, Conn.: Appleton & Lange; 1998.

Film Sizes

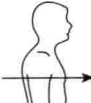
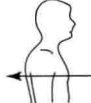
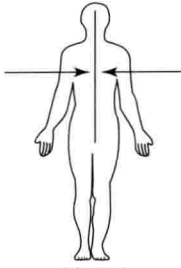
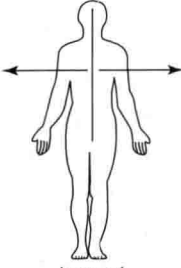
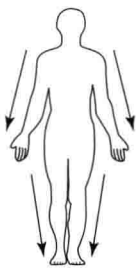
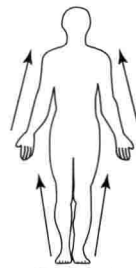
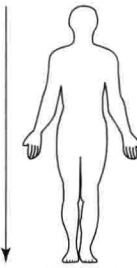
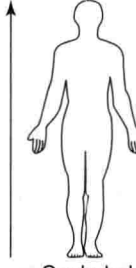
Radiographic film and cassettes come in many different sizes to fit various needs. Not all radiology departments or offices will have all the sizes available. For this reason, more than one acceptable film or cassette size may be identified for many of the projections included in this manual.

Film and cassettes are currently measured in two different ways: inches and centimeters. Although the metric-sized film is not necessarily the same size as the standard unit film, they are often used interchangeably. For example, a 24 cm × 30 cm film is slightly smaller than a 10 in. × 12 in. film, but in departments that stock only 24 cm × 30 cm

film, this size is often referred to as 10 in. × 12 in. film. Because most radiographers use the standard unit sizes in practice, recommended film sizes in this manual will be in inches. Use the following chart to find the corresponding size in centimeters.

| Standard Unit (inches) | Metric Unit (centimeters) |
|------------------------|---------------------------|
| 8 in. × 10 in. | 20 cm × 25 cm |
| 9 in. × 9 in. | 24 cm × 24 cm |
| 10 in. × 12 in. | 24 cm × 30 cm |
| 11 in. × 14 in. | 28 cm × 35 cm |
| 7 in. × 17 in. | 18 cm × 43 cm |
| 14 in. × 17 in. | 35 cm × 43 cm |

TABLE 1-3. Directional/Relationship Terminology

| | | | |
|--|--|---|---|
|  <p>Anterior</p> |  <p>Posterior</p> |  <p>Medial</p> |  <p>Lateral</p> |
| <p>Anterior/Ventral: The front or forward aspect of the body or body part.</p> | <p>Posterior/Dorsal: The back part of the body or body part.</p> | <p>Medial/Mesial: Toward the median plane or middle of a part; opposite of lateral (eg, the spine is medial to the kidneys).</p> | <p>Lateral: Away from the median plane or middle of a part; opposite of medial (eg, the kidneys are lateral to the spine).</p> |
|  <p>Distal</p> |  <p>Proximal</p> |  <p>Caudal</p> |  <p>Cephalad</p> |
| <p>Distal: Parts furthest from the point of origin or attachment (eg, the fingers are distal to the wrist); opposite of proximal.</p> | <p>Proximal: Parts closest to the point of origin or attachment (eg, the elbow is proximal to the wrist); opposite of distal.</p> | <p>Caudad/Caudal/Inferior: Away from the head or toward the tail or feet; opposite of cephalad.</p> | <p>Cephalad/Cephalic/Cranial/ Superior: Pertaining to or toward the head; opposite of caudad.</p> |

From Cornuelle AG, Gronefeld DH. Radiographic Anatomy & Positioning: An Integrated Approach. Stamford, Conn.: Appleton & Lange; 1998.

Cassette Orientation

Most cassettes are rectangular in shape and may be positioned crosswise or lengthwise relative to the body part. Radiology departments and offices usually have specific guidelines pertaining to the orientation, or positioning, of the cassette. These policies may be due to physician preference or may be adapted to meet patient condition. The recommendations in this manual relative to cassette orientation may be changed to fit the department routine. Generally speaking:

1. The long side of the cassette should be parallel to the long axis of long bones or other long structures,
2. When two projections are going to be included on one film, the cassette is masked crosswise. An exception to this is the foot. Although both the AP and oblique foot projections are generally included on one film, the cas-

sette is masked lengthwise because the foot is a long structure.

Although there may be exceptions to these two rules, they should serve as a guide when orienting the cassette.

Using Lead Identification Markers

Lead markers are used to identify the right or left side of the patient, the patient's position, or a specific film in a series of films. They provide necessary information important in patient diagnosis. For medicolegal reasons, films should be correctly marked before processing. To avoid superimposition on critical anatomy and to assure inclusion in the collimated area, markers must be strategically placed on the cassette. Some radiology departments may have their own specific guidelines for marker use; however, the following general rules for using lead markers should be

helpful in determining marker placement for each projection.

RULES FOR USING LEAD MARKERS

1. Right or left markers *must* be used on *all** films.
2. Markers should be placed on the cassette where they will be seen clearly on the radiograph, while not obscuring required anatomy.
 - a. Markers should not be placed over the patient identification blocker.
 - b. Markers should be placed within the collimation field.
 - c. Markers should be placed away from an area where lead shielding on the patient or table may obscure the markers.
3. Markers must be placed appropriately to identify the *patient's* right or left side.
4. When radiographing the extremities and hip or shoulder girdles, markers should be placed on the lateral side of the body part.
5. When using one film for two projections of the same body part (eg, PA and oblique right hand), only one of the projections must be marked.
6. If bilateral projections (eg, right and left AP knees) are positioned on one film, both right and left markers should be used to identify the corresponding sides.
7. Auxiliary markers (eg, post-evac, post-void, minute markers, etc) should be used whenever possible and positioned away from the critical anatomy.
8. When performing lateral decubitus projections, a marker indicating the side that is up should be placed on the upside of the cassette, away from any anatomy of interest.
9. For lateral projections, a marker indicating the side closest to the film should be used.
10. When radiographing the spine in the lateral position, markers should be placed on the cassette anterior to the spine to be clearly visualized (not “burned out” or obscured by lead masking on the table behind the patient).

11. When radiographing the chest, abdomen, or spine in an oblique position, the side nearest the film is generally marked. For example, when obtaining an LPO projection of the lumbar spine, a left marker would be placed on the cassette to identify the patient's left side. When both sides are on the film (eg, barium enema or oblique chest), either marker can be used.**

***Exception:** To prevent superimposition of the marker on critical anatomy, many hospitals have a policy restricting marker use in surgery.

******The marker may also be used to identify the anatomical structure(s) seen on the projection. For example, an LPO position is used to demonstrate the right sacroiliac joint; therefore, a right marker could be used. Radiographers should follow department policy when using markers.

From Cornuelle AG, Gronefeld DH. Radiographic Anatomy & Positioning: An Integrated Approach. Stamford, Conn.: Appleton & Lange; 1998.

Radiation Protection

One of the primary responsibilities of the radiographer is to protect others from unnecessary exposure to ionizing radiation. Two methods the technologist can use to minimize patient dose are cited throughout this text—collimation and gonadal shielding. Although gonadal shielding may not be necessary for all anatomical areas and for all patients (ie, elderly patients), it is a habit the radiographer should adopt. Those who shield patients on a regular basis never have to stop to consider whether a female patient may be pregnant or what potential effects the radiation may have on the patient.

Closure

Patient positioning may seem awkward and tedious at first; however, the student radiographer will soon feel comfortable performing radiographic examinations. If knowledge of basic patient positioning is acquired for agile, cooperative patients, the radiographer can quickly learn to adapt basic positioning for those patients who are unable to assume the textbook position.

RESPIRATORY SYSTEM

- ▶ PA CHEST
- ▶ LATERAL CHEST
- ▶ PA OBLIQUE CHEST (RAO & LAO)
- ▶ LATERAL DECUBITUS (AP OR PA) CHEST
- ▶ LORDOTIC CHEST (LINDBLOOM METHOD)

► PA CHEST

- OBJECTIVE:** After practice, each student will position a patient for a PA projection of the chest.
- PATIENT PREP:** Remove all clothing and jewelry from the waist up; gown patient.
- FILM:** 14 in. × 17 in. lengthwise or crosswise, grid or non-grid.

| TASK ANALYSIS | | CORRECTLY PERFORMED? | |
|--|--|----------------------|----|
| MAJOR STEPS | KEY INFORMATION | YES | NO |
| 1. Assist the patient to an erect position facing the upright grid device or cassette holder. | If the patient is unable to sit or stand, an AP projection may be obtained with the patient sitting or lying supine; a horizontal beam is required to demonstrate air–fluid levels. | | |
| 2. Center the midsagittal plane of the body to the midline of the film with the patient's weight equally distributed on both feet. | | | |
| 3. Adjust the height of the cassette so the upper border of the film is 1 1/2 to 2 in. above the top of the shoulders. | Women with large pendulous breasts should be asked to pull them superiorly and laterally. | | |
| 4. Extend the chin upward so it rests on the top of the cassette holder, if possible; adjust the head so there is no rotation. | The chin should be “stretched up” somewhat. When using an upright grid device, it may be impossible to extend the chin over the top edge. | | |
| 5. Position the patient with the backs of the hands on the hips; depress the shoulders and roll them forward to contact the cassette holder. | Make sure the hands are not high enough to be in the lung fields. The shoulders should be relaxed. Immobilize unsteady patients with a restraining band. | | |
| 6. Using 72-in. SID, direct the central ray to the midline of the patient at the level of T-7. | T-7 lies approximately 7 to 8 in. below the spinous process of C-7; the central ray will enter near the level of the inferior angles of the scapulae. The central ray may not be centered to the cassette. | | |
| 7. Collimate to include the apices, lateral margins of the ribs, and costophrenic angles; use gonadal shielding. | The upper airway should also be included in small children. | | |
| 8. Make the exposure during suspended <i>in-spiration</i> , after the 2nd deep breath. | To demonstrate pneumothorax, foreign body, and fixation of the diaphragm, an additional full expiration radiograph may be needed. | | |

CRITICAL ANATOMY: Heart shadow, aortic arch, both lungs, hilum, apices, costophrenic angles, the air-filled trachea, and both hemidiaphragms.

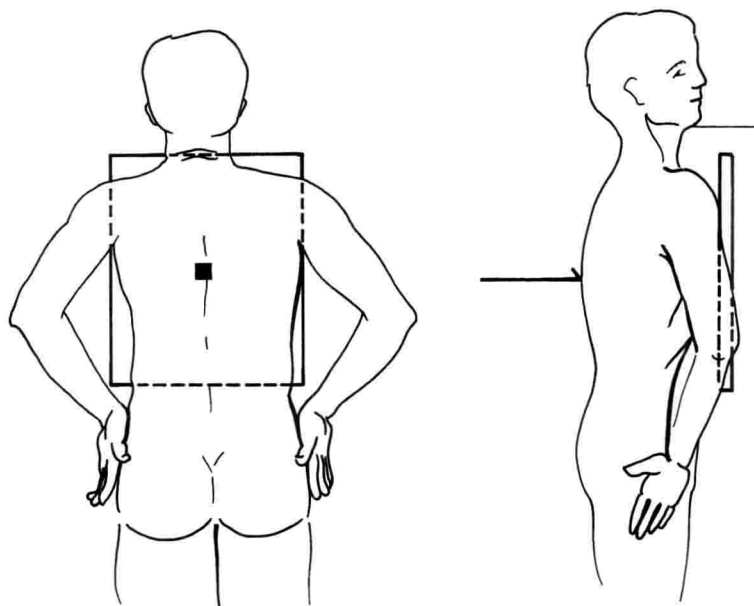


FIGURE 2-1. PA chest.

NOTES

EVALUATOR SIGNATURE _____ DATE _____