

X-Ray Tech



Essentials of DR Images & Modalities, Positioning Basics, Imaging Basics, Classic Radiographic Signs, Findings & Terminology

OVERVIEW

Scope of Practice

- **X-Ray Tech** (a.k.a., **Diagnostic Radiology (DR)**) involves using x-rays in **diagnostic procedures**.
- X-rays, like visible light, are a form of **electromagnetic radiation**, so care must be taken to ensure that patients are **not overexposed**.
- In addition, **X-Ray Tech/DR** requires certain skills, practice and technology:
 - patient care
 - quality control
 - computer data acquisition & processing

- radiation safety
- **DR** is also connected to quantitative sciences, including:
 - chemistry
 - radiation biology
 - physics
 - computer technology

How DR Works

- The x-ray machine works by using individual x-ray particles (a.k.a., photons)

- As these x-ray particles pass through the body, a computer (or a special kind of film) records the images created.
- Also called **Radiography**, DR is similar to photography; the patient and x-ray machine are positioned according to the part of the body to be studied and the type of procedure requested by the physician.
- The recorded images then can be evaluated and used for diagnosis by the physician.

NOTE TO STUDENT: For more information on **Radiation Therapy**, see the QuickStudy for **Radiation Therapy**, which outlines the course curriculum for it, including more in-depth discussion of **Radiophysics** and **Radiobiology**; because of its complex subject matter, this guide features two glossaries: **Glossary of Clinical Terminology** and **Glossary of Radiographic Terminology**.

X-RAY TECH/DR – GETTING STARTED

Understanding Radiophysics

Ionizing Radiation

- Absorption of energy from radiation of sufficient energy to cause ejection of one or more orbital electrons from the atom or molecule; ionizing radiation can be **electromagnetic** or **particulate**.
- **Electromagnetic radiation** consists of **x-rays** and **gamma rays**, which differ only in the manner in which they are produced:
 - x-rays are produced in an **electrical machine**
 - gamma rays are emitted from the nucleus of **radioactive isotopes**
- **Electromagnetic radiation is indirectly ionizing**; that is, x-rays and gamma rays give up their energy to produce fast-moving charged particles that induce damage:
 - **Particulate radiation** consists of **subatomic particles** (i.e., electrons, protons, alpha particles, neutrons, negative pi-mesons [pions] and heavy ions)
- **Particulate radiation is directly ionizing**; that is, it can potentially produce chemical and biological changes and directly disrupt the atomic structure.

Electromagnetic Radiation

Three dominant absorption mechanisms of electromagnetic radiation exist, largely depending upon the energy of the radiation:

1. **photoelectric absorption**
2. **Compton effect** (a.k.a., **Compton scattering**)
3. **pair production**

Production of X-Rays

- X-rays are produced by a vacuum tube that uses high voltage to accelerate electrons from a cathode to a high velocity.
- X-rays are generated when the electrons collide with a tungsten target, the **anode**.
- The principal interaction in x-ray production results in the output of "bremsstrahlung," or "braking," radiation.
- **Bremsstrahlung** accounts for approximately **75% to 80%** of the tube's output and is produced by the sudden deceleration of the high-speed electron as it is deflected around the nucleus of the tungsten atom.
- **Radi**: the historic unit for absorbed dose, derived from the acronym for radiation absorbed dose.
- **Röntgen (R)**: unit of exposure, defined as the amount of ionization produced by a beam of radiation in air.

The Tech Knows

X-ray films appear in black and white; dense structures (i.e., bones, which block photons/light), appear white, as do metal and contrast dye used to highlight areas of the body's structures containing air, as well as muscle, fat and fluids, all appear in varying shades of gray.

Absorbed Dose

- Amount of energy absorbed per unit mass of absorbing material
- Describes the interaction of radiation with matter
- Measured in joules per kilogram (J/kg)

DR IMAGES & MODALITIES

Angiogram: procedure used to evaluate blood vessels and organs of the body by using x-ray based techniques including **fluoroscopy**, **plane x-rays** and **CT**, as well as **MR imaging**.

- **Radiopaque contrast agents** are injected into the blood vessel and the images are recorded and studied.
- Used extensively in the heart, brain and kidneys.

Bone scan: a nuclear medicine ("nuc med") procedure in which a **radioisotope** (i.e., technetium-99) is imaged after localization in bones to show **abnormalities**.

- The more active the bone turnover (osteoblastic change), the greater the concentration of the radioisotope.
- Tumors, fractures, arthritis and infections all may show up as "hot spots" (areas of increased uptake).
- Patterns of uptake and, as in all radiological interpretations, clinical history both help to differentiate these entities.
- **Destructive** (a.k.a., **lytic**) lesions (osteoclastic change) **may NOT show up on a bone scan**.

Bone survey: a series of x-rays of the skull, spine, arms, ribs and legs.

- **More likely to show lytic lesions** (osteoclastic change) than a bone scan.
- Important diagnostic test in **multiple myeloma**.

CT (computed tomography) scan: medical imaging technique developed from tomography, a procedure that acquires an image of a single "slice" of the body.

- In CT, a large series of x-ray images (a.k.a., "slices") are quickly acquired around a single axis of rotation, allowing them to be reassembled in three dimensions (3-D), producing a **high-resolution image**.
- CT has revolutionized medical imaging over the past 30 years.

CXR (chest x-ray): radiographic test ordered to view the thorax and its component organs in order to diagnose various conditions, including **pneumonia** and **lung cancer**.

- CXR is among the first diagnostics ordered when patients present with symptoms of respiratory distress.

Fluoroscopy: technique used to acquire **real-time images** of internal structures and medical interventions using x-rays and sophisticated **fluorescent screens**.

- In use for over 100 years, fluoroscopy still plays an important role in radiography.
- Because it is often used to monitor an intervention or observe moving images, care must be taken to closely monitor patient's **radiation exposure**.

Gamma camera: a device used to image gamma radiation emitted from radioisotopes.

- Used in nuc med studies such as **bone**, **SPECT** and **PET scans**.

Interventional Radiology: subspecialty of radiology used for both **diagnostic** and **therapeutic** purposes.

- Minimally invasive procedures are performed using radiographic image guidance.

IVP (intravenous pyelogram): contrast-enhanced study of the kidneys and renal collecting system.

- Usually consists of a series of films taken as the **contrast dye moves** through different parts of the urinary system.

KUB: a non-contrast-enhanced radiographic study of the abdomen.

- Because it primarily includes the kidneys, ureter and bladder, the test has been given the acronym KUB.

Lymphangiogram: special contrast-enhanced x-ray of lymph nodes and lymph vessels, which are **NOT seen on standard x-rays**.

Xray Tech Study Guide For State Exam

N Noddings



Xray Tech Study Guide For State Exam:

Unveiling the Magic of Words: A Review of "**Xray Tech Study Guide For State Exam**"

In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their power to kindle emotions, provoke contemplation, and ignite transformative change is actually awe-inspiring. Enter the realm of "**Xray Tech Study Guide For State Exam**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve to the book is central themes, examine its distinctive writing style, and assess its profound impact on the souls of its readers.

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