

Radiology Team 429

Introduction to Radiology



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In this team we used the outlines from the:

- Doctor's slides
- Lecture notes
- 427 Radiology team
- Diagnostic Imaging –PETER ARMSTRONG – 6Th Edition

- Sorry we don't hold responsibility for any missing information or – perhaps -wrong material.
- We tried our best to present this lecture in the best way, and we hope what we wrote is enough to cover the subjects.

Team Leaders:

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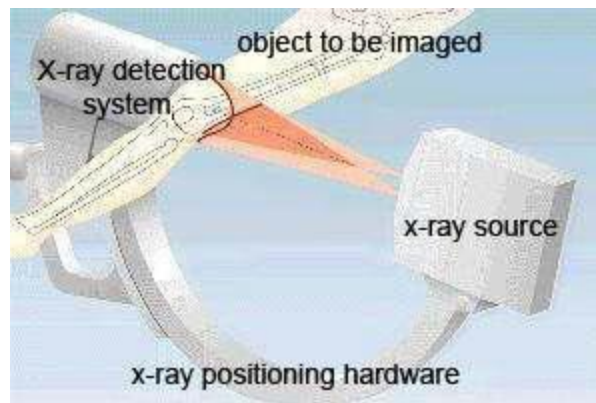
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Best Wishes :)

A) X-RAY

- Regular x-rays (plain x-rays) account for about 80% of imaging examinations.
- X-ray examinations, or plain x-rays, are made by an x-ray beam passing through the patient. **The x-rays are absorbed in different amounts by the various tissues or materials in the body.**
- X-ray machine is composed of an **X-ray source** or **X-ray tube**, an **X-ray detection system**, and **positioning hardware** to align these two components with the object to be imaged.



- The classic imaging receptor is a film/screen combination. Newer systems are called computed radiography or digital radiography.

Four basic densities, or shades, are visible on plain films. These are air, fat, water (blood and soft tissue), and bone. Air is black or very dark. On x-rays, fat is generally gray and darker than muscle or blood (Fig. 1-2). Bone and calcium appear almost white.

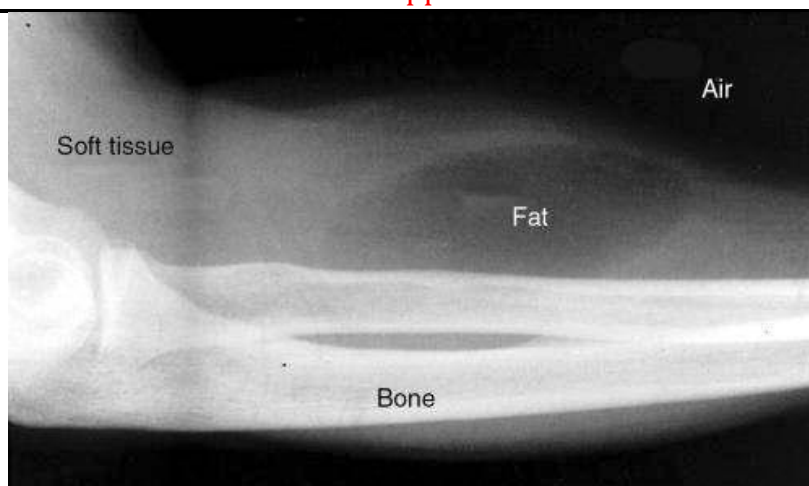


Figure 1-2 The four basic densities on an x-ray. The abnormality in this case is the fat in the soft tissue of the forearm, which is due to a lipoma.

- **X-ray radiation cause ionization in the body (very imp. to know which technique causes ionization and which don't)MCQ.**

- Remember that standard or plain x-rays are **two-dimensional** presentations of three-dimensional information. That is why frontal and lateral views are often needed.
- Chest x-rays are usually described as **posteroanterior (PA)** or **anteroposterior (AP)** (Fig. 1–3).
 - These terms indicate the direction in which the x-ray beam traversed the patient on its way to the detector.
 - **PA means that the x-ray beam entered the posterior aspect of the patient and goes out anteriorly.**
 - **AP means that the beam direction through the patient was anterior to posterior.**
 - A left lateral decubitus view is one taken with the patient's left side down.

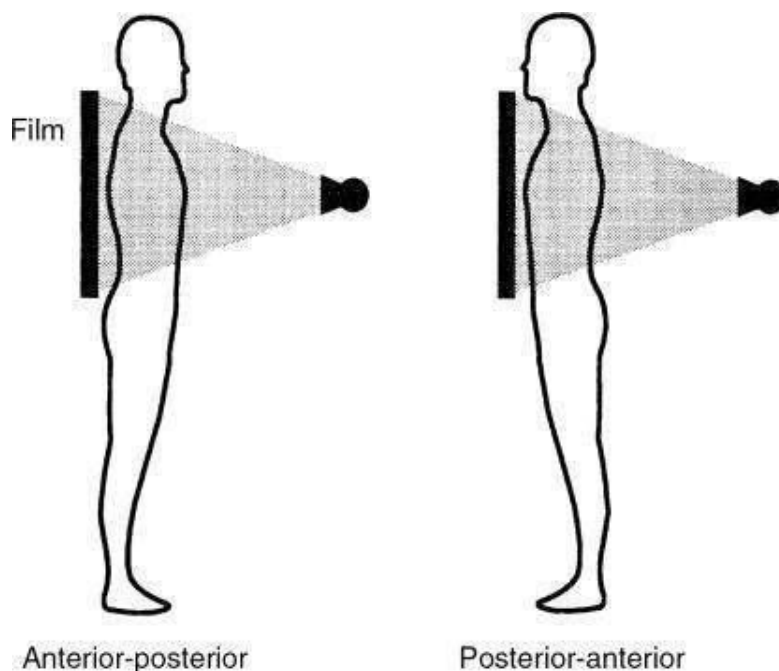


Figure 1-3 Typical x-ray projections. X-ray projections are typically listed as AP or PA. Lateral (LAT) and oblique (OBL) views also are commonly obtained.

- Use of contrast agents permits visualization of anatomic structures that are not normally seen.
- Contrast agents are used to fill either a **hollow viscus** (such as the stomach) or **anatomic tubular structures** that can be accessed in some way (such as blood vessels, ureter, and common bile duct).
- Contrast agents are administered orally, rectally, or retrograde into the ureter or bladder. There is little or no risk unless aspiration or perforation occurs. With the intravenously or intra-arterially administered agents, a small but real risk of contrast reaction exists.
- **X-ray is highly contraindicated in pregnancy because of the radiation effect on the fetus...MCQ !!**

B) COMPUTED TOMOGRAPHY (CT Scan)

- Computed tomography (CT) is accomplished by passing a rotating fan beam of x-rays through the patient and measuring the transmission at thousands of points.
- The data are handled by a computer that calculates exactly what the x-ray absorption was at any given spot in the patient.
- The data can be displayed on a screen, or photographed.



- Compared with plain x-rays, CT uses about 10 to 100 times more radiation.
- It causes Ionization in the body.

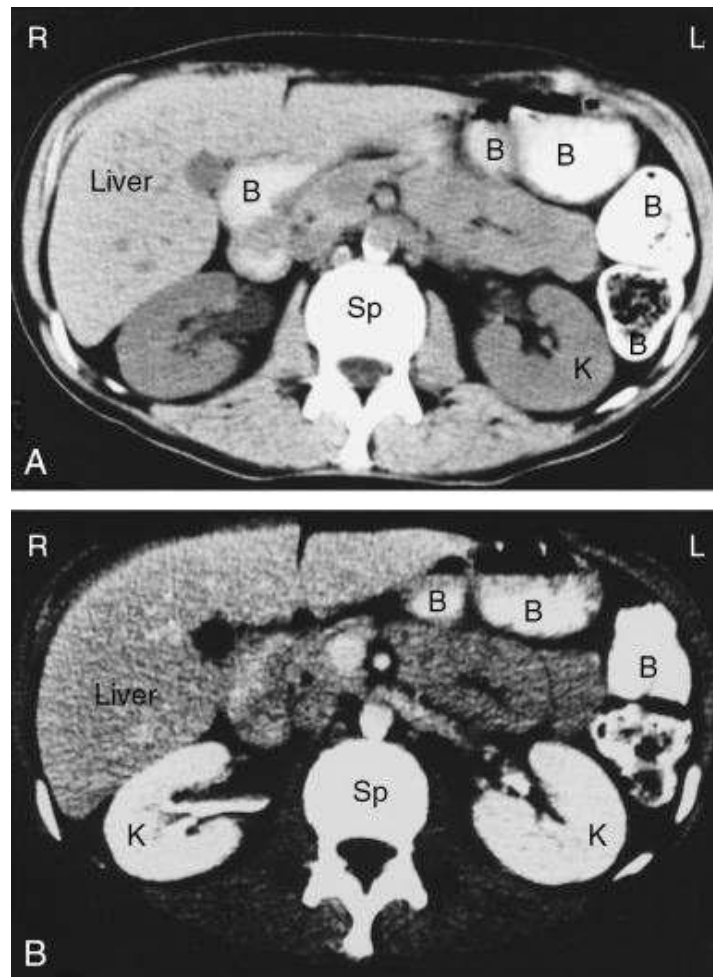


Figure 1-5 Computed tomography (CT). B = Bowel , K = Kidney

- In general, the basic four densities on CT images are the same as those in plain x-rays: air is black, fat is dark gray, soft tissue is light gray, and bone or calcium and contrast agents are white.
- One advantage of CT is that actual x-ray absorption of a specific tissue can be displayed. The greater sensitivity of CT compared with plain x-rays allows areas of tiny punctuate calcification to be seen.
- CT scans are presented as a series of slices of tissue. Thus CT is a two-dimensional display of two-dimensional information, and objects appear where they really are in space.
- The scans or slices are shown as if you are viewing the patient from the foot of the patient's bed. Thus the individual's right side is on your left (Fig. 1-6). This also is the convention used for the transverse images of ultrasound and magnetic resonance imaging (MRI).

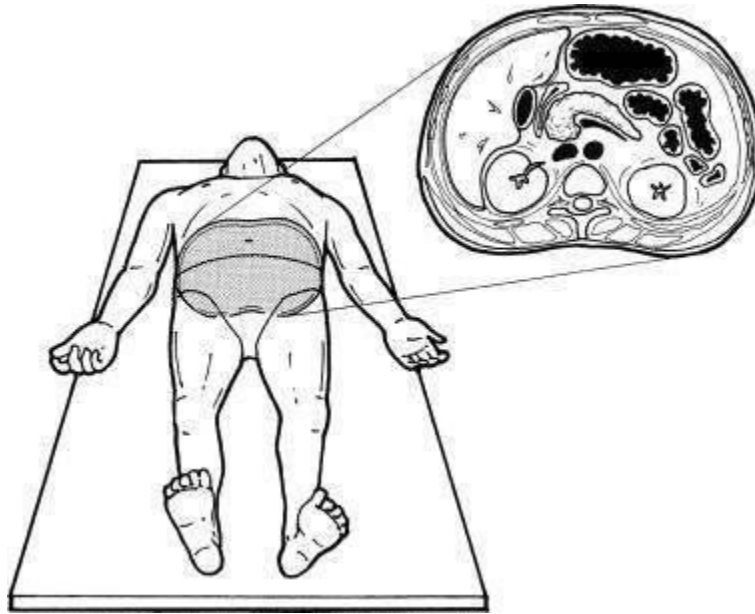


Figure 1-6 Orientation of computed tomography (CT) and magnetic resonance (MR) images. CT and MR usually present images as transverse (axial) slices of the body. If, as you stand and look at the patient from the foot of the bed, you think of these images as slices lifted out of the body, you will have the orientation correct.

- CT is essential in the evaluation of many traumatic conditions in various bone and soft tissue tumors because of its cross sectional imaging capabilities.
- Contrast agents, frequently used in CT scans, are usually the same used in other imaging studies.
- **CT is highly contraindicated in pregnancy because of the radiation effect on the fetus MCQ!!!**

C)ULTRASOUND

- **Ultrasound examination uses high-frequency sound waves to make images.**
- The image is made by sending high-frequency sound into the patient and assessing the magnitude and time of returning echoes
- Tissues such as liver and spleen give a picture with **small echoes** due to the fibrous interstitial tissue (Fig. 1-4). **High-intensity** echoes are caused by calcification, fat, and air.

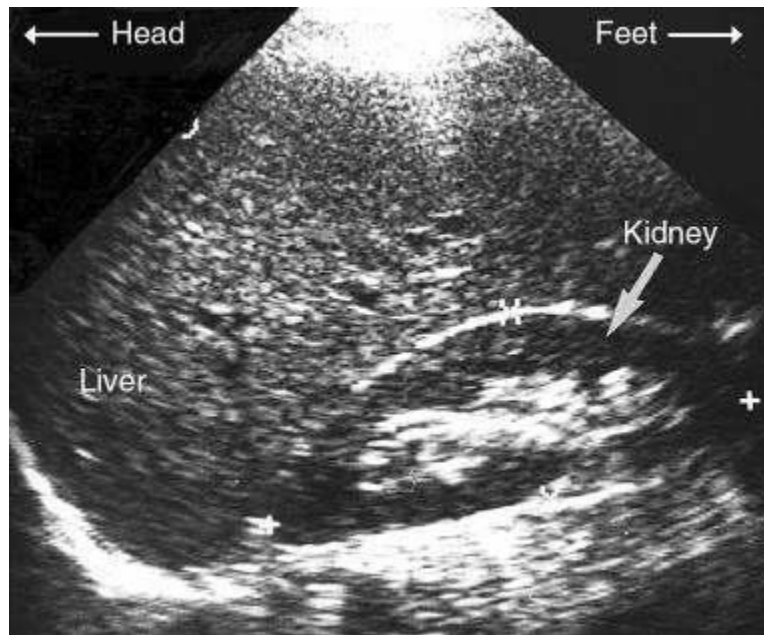


Figure 1-4 Ultrasound examination of the liver and kidney.

- Ultrasound exams do not use ionizing radiation MCQ!!!

- That is why we use Ultrasound rather than x-ray in examining fetus in pregnancy. MCQ !!!

Advantages of Ultrasound:

- US is noninvasive (no needles or injections) and is usually painless.
- US is widely available and less expensive than other imaging methods.
- US uses no ionizing radiation.
- US gives a clear picture of soft tissues that do not show up well on x-ray images.
- US no health problems and may be repeated if medically indicated.
- US is the preferred imaging modality for the diagnosis and monitoring of pregnant women and their unborn infants.
- Ultrasound provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspiration of fluid in joints or elsewhere.

Limitation of Ultrasound:

- Ultrasound waves are reflected by air or gas; therefore ultrasound is not an ideal imaging technique for the bowel. (Barium exams and CT scanning are the methods of choice for bowel-related problems) **MCQ !!!**
- Ultrasound waves do not pass through air; therefore an evaluation of the stomach, small intestine and large intestine may be limited – even though it might be used. Intestinal gas may also prevent visualization of deeper structures such as the pancreas and aorta (although we use ultrasound to examine these structures but intestinal gas may prevent clear visualization)
- Patients who are obese are more difficult to image because tissue attenuates (weakens) the sound waves as they pass deeper into the body.

- Ultrasound has difficulty penetrating bone and therefore can only see the outersurface of bony structures and not what lies within. **For visualizing internal structure of bones or certain joints, other imaging modalities such as MRI are typically used.**

Preparation of Ultrasound:

- Preparation depends on the type of examination you will have. For some scans your doctor may instruct you not to eat or drink for as many as 12 hours before your appointment. For others you may be asked to drink up to six glasses of water two hours prior to your exam and avoid urinating so that your bladder is full when the scan begins.

Uses of Ultrasound:

Ultrasound is a useful way of examining many of the body's internal organs, including but not limited to the:

- heart and blood vessels, including the abdominal aorta and its major branches
- liver
- gallbladder
- spleen
- pancreas
- kidneys
- bladder
- uterus, ovaries, and unborn child (fetus) in pregnant patients
- thyroid and parathyroid glands
- scrotum (testicles)

Doppler ultrasound images can help the physician to see and evaluate:

- blockages to blood flow (such as clots)
- narrowing of vessels (which may be caused by plaque)
- tumors and congenital malformation

D) MAGNETIC RESONANCE IMAGING (MRI)

- Magnetic resonance imaging (MRI) generates images by applying a varying magnetic field to the body.

Disadvantages of MRI:

- very sensitive to patient movement ,
- cannot bring metallic objects near the machine – so if the patient have metallic implants like MR is avoided
- High cost

Advantages of MRI are:

- It obtains exquisite images of the central nervous system and stationary soft tissues (such as the knee joint).
- It does not use ionizing radiation.
- MRI can distinguish abnormal tissues from normal tissues much more accurately than other imaging tests (x-ray, CT, etc).

- MRI images allow the physician to clearly see even very small tears and injuries to tendons, ligaments and muscles and some fractures that cannot be seen on xrays.
- MR images of the soft-tissue structures of the body (particularly muscles, bones and joints) are clearer and more detailed than with other imaging methods. This detail makes MRI an invaluable tool in early diagnosis and evaluation of many conditions, including tumors.

Contraindication of MRI:

- Any electrically, magnetically or mechanically activated implants (like cardiac pacemakers, cerebral aneurysm clips) are considered as an absolute contraindication .
- Pregnancy: MRI has no harmful effect on fetus but it is relatively contraindicated during the first trimester of pregnancy (Risk Vs Benefit ratio to be assessed) MCQ.
- Claustrophobia is also relatively contraindicated

In all the previous Radiology Modalities body reaction to contrast agents (there is a low but non-negligible level of risk) should be considered .

Terms you should memorize:!!!!!!!!!!

- **Barium enema**, is a medical procedure used to examine and diagnose problems with the human colon (large intestine). X-ray pictures are taken while barium sulfate fills the colon via the rectum.
- **Sialogram** or sialography is imaging of the salivary glands using x-ray MCQ !!!
- **Myelography** is a type of radiographic examination that uses a contrast medium to detect pathology of the spinal cord,
- **Angiography** or **arteriography** is a medical imaging technique used to visualize the inside, or lumen, of blood vessels and organs of the body, with particular interest in the arteries, veins and the heart chambers. This is traditionally done by injecting a radio-opaque contrast agent into the blood vessel and imaging using X-ray based techniques such as fluoroscopy
- Arteriogram = arteries
- Venogram = veins
- **Pyelogram** (or **pyelography** or **urography**) is a form of imaging of the renal pelvis and ureter

MCQs about this subject included:

- * What modality causes ionizing in the body (CT + X-RAY)
- * What modality is absolutely contraindicated in pregnancy (CT + X-RAY) and what is relatively contraindicated (MRI - benefit vs. risk -) and what is safe to be used (ULTRASOUND) .

DONE ..