IMAGE PROCESSING AND IMAGE QUALITY

Dr. Mahmoud S Dahoud

Radiology Equipment Technician I (X-Ray)

Fall semester

Week 7

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Outline (lectures 7+8)

- Image processing
- DDR (Flat Panel detectors, Indirect Conversion Detectors))
- Direct Conversion Detectors
- Image Quality
- Factors affect image quality

Objectives

The student should be able to do the followings;

- Explain Image processing
- Differentiate DDR types (Flat Panel detectors, Indirect Conversion Detectors))
- Explain the direct conversion detectors
- Mention the factors affecting image quality

Image processing

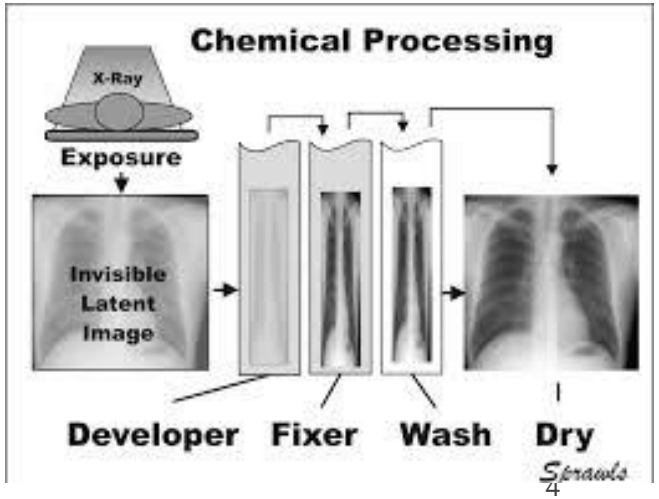
1- Development: - Developer solution (e.g. hydroquinone or phenidone) is used to reduce more silver ions into silver atoms while the developer solution itself is oxidised. Unexposed silver grains will also be developed much later. Fogging is the development of unexposed silver halide crystals.

2- **Fixing:** The purpose is to remove the remaining unreacted silver halide crystals. Silver halide crystals are only slightly soluble in water. Sodium thiosulfate or ammonium thiosulfate is used as fixing agent.

3- **Washing:** Washing is a process whereby the remaining fixed agent are removed. Incomplete washing will cause the film to turn brown after prolonged storage. This is because the remaining fixing agent will react with silver atoms to form silver sulfide which is brown in color.

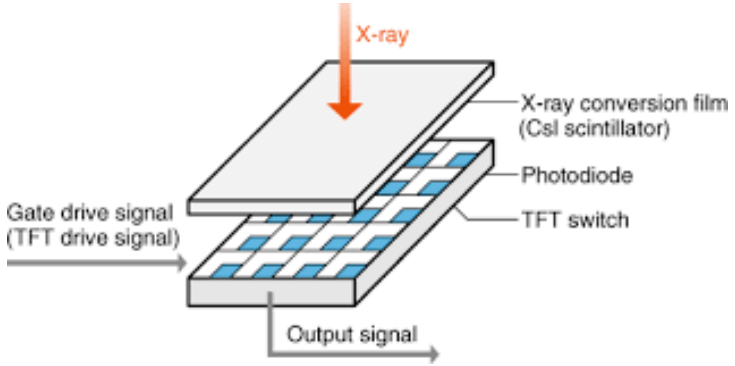
4- Drying: This process is to remove excessive water from the film.

(https://www.youtube.com/watch?v=jlQuN7ZVB48)



Direct digital radiography DDR

Direct digital radiography is a type of digital radiography in which the digital registration of the image takes place directly at the detector with no intermediate processing step such as cassette readout in computed radiography (CR).



Detector types

- **Flat panel detectors (FPDs):** These are the most common detectors used in direct digital radiography. There are two primary methods of converting the x-rays into charges, either indirect or direct.
- **Indirect conversion:** uses a scintillator to convert x-rays to visible light before conversion from visible light to an electrical charge for subsequent readout.
- **Direct conversion:** directly converts the x-rays into proportionally sized electrical charges with no intermediate scintillating step.

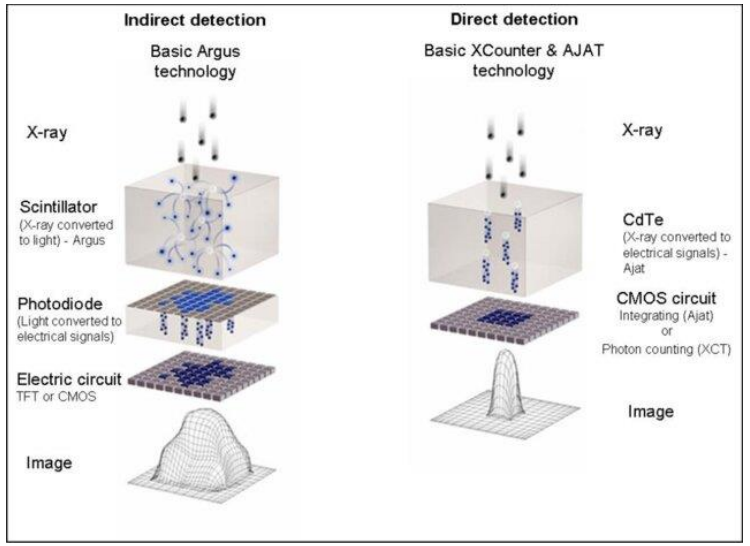


IMAGE QUALITY

Radiographic image quality: is the exactness of representation of the patient's anatomy on a radiographic image.

Factors influences the quality of a radiographic image:

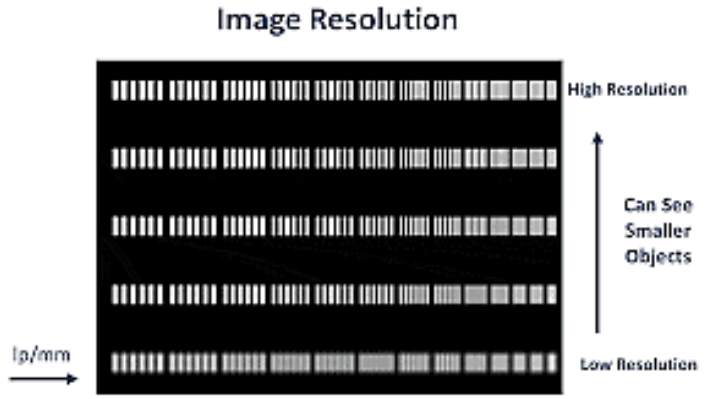
1- film factors, 2- geometric factors, 3- subject factors

The most important characteristics of radiographic image quality are:

1- spatial resolution, 2- contrast resolution, 3- noise, 4- artifacts.

Resolution is the ability to separate objects and visually distinguish one from the other.

Spatial resolution: refers to the ability to image small objects that have high subject contrast, such as a bone–soft tissue interface, a breast microcalcification, or a calcified lung nodule.



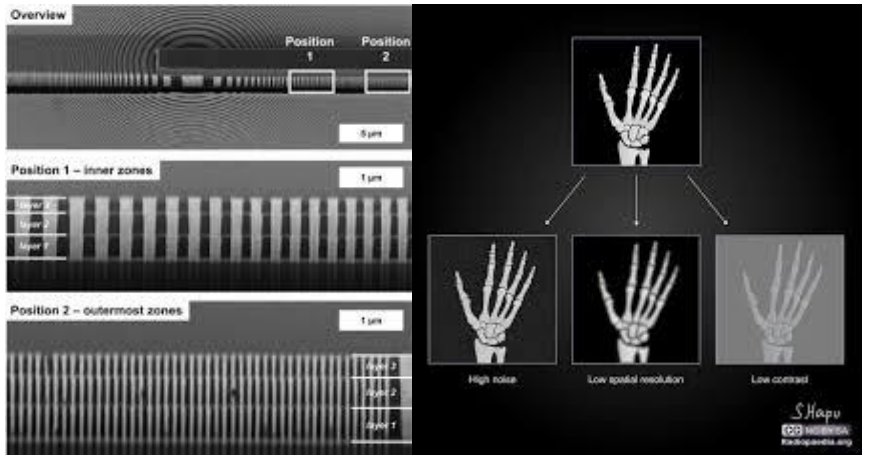
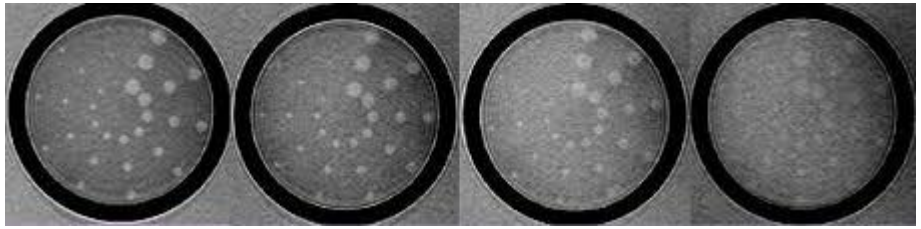
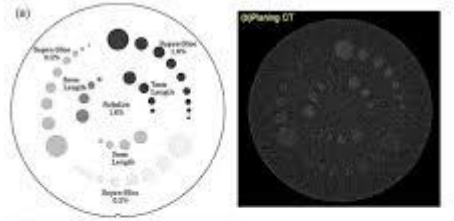
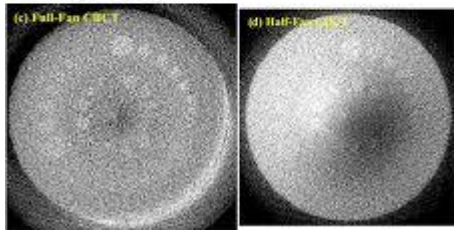


IMAGE QUALITY

Contrast resolution is the ability to distinguish anatomical structures of similar subject contrast such as liver–spleen and







Radiographic noise : is the random fluctuation in the optical density of the image.

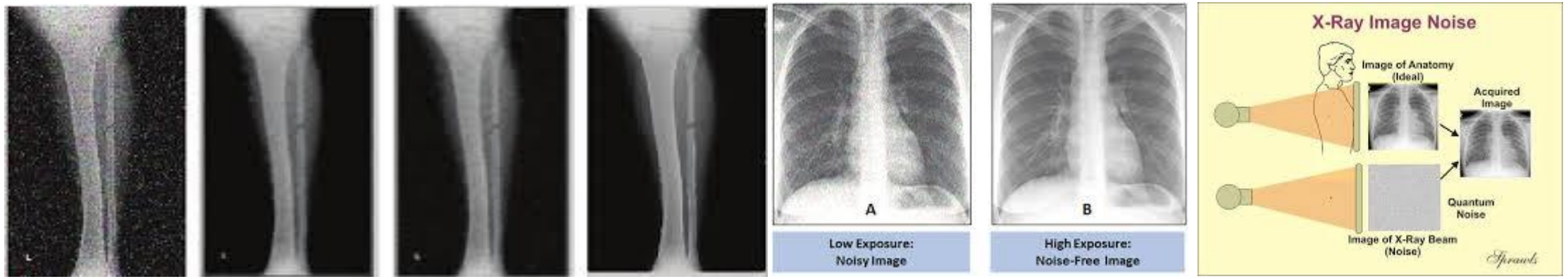


IMAGE QUALITY

An artifact is any irregularity on an image that is not caused by the proper shadowing of tissue

Three types of artifacts: 1- exposure artifacts 2- processing artifacts 3- handling and storage artifacts

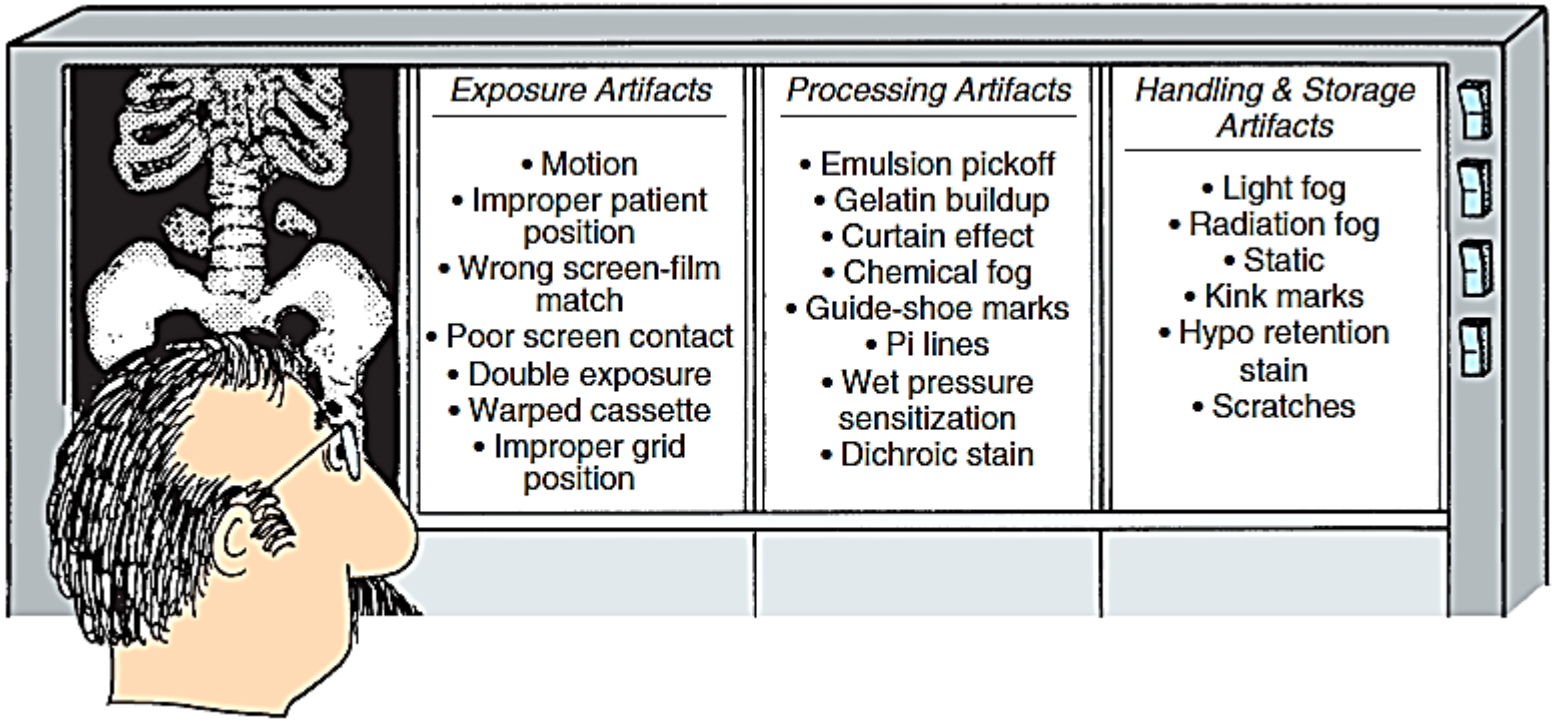


FIGURE 19-1 Screen-film radiography artifact classification.

IMAGE QUALITY

Geometric unsharpness : the loss of definition that is the result of geometric factors of the radiographic equipment and setup. It occurs because the radiation does not originate from a single point but rather over an area.

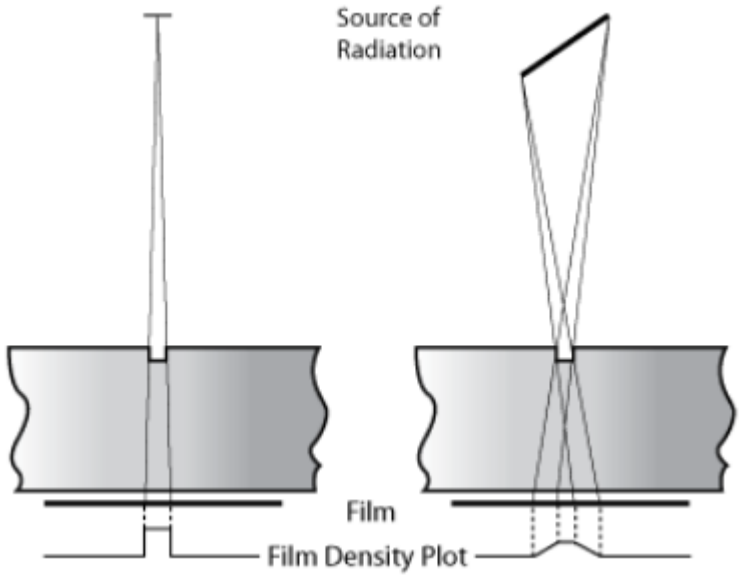
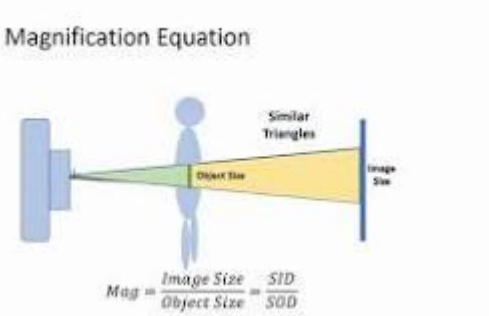


IMAGE QUALITY

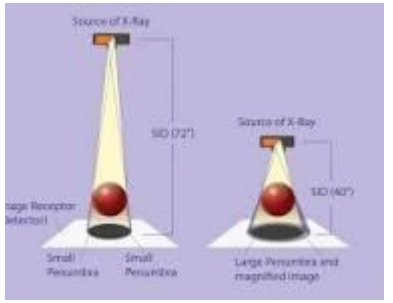
Magnification in radiography : (Image Size/Object Size) and is equal to the (SID/SOD) which is the source to image distance divided by the source to object distance.

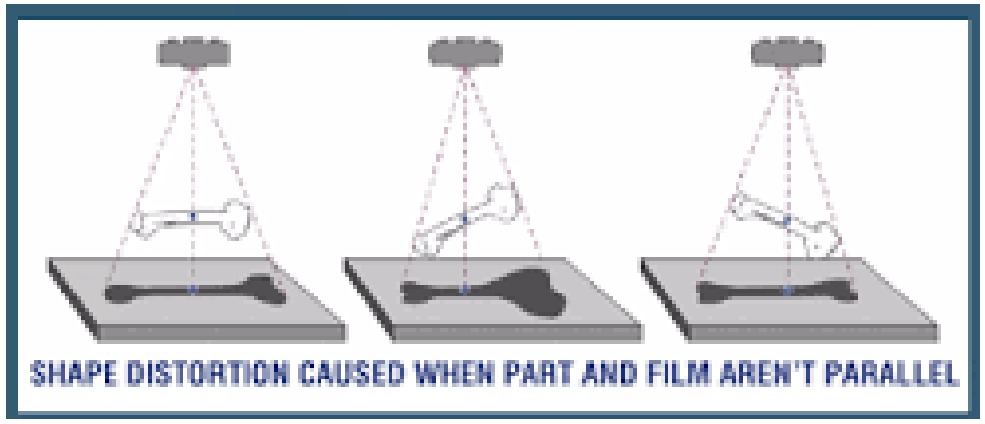
the object will appear larger on the detector than the true object size.

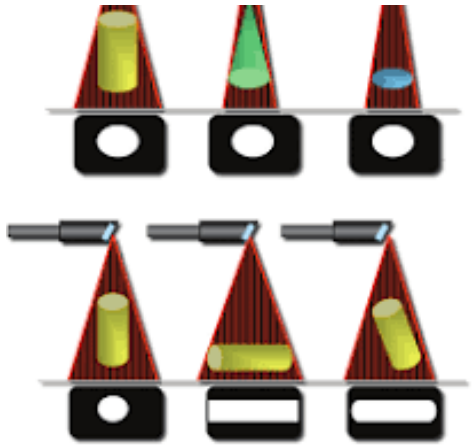


Distortion of an image : is any misrepresentation or inaccurate impression of the target structure.

Size distortion is magnifying the anatomical structure and is usually caused by an increased object-to-image receptor distance or decreased distance between the source of radiation and the image receptor







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