

What is Digital Imaging?

Digital imaging is the process of capturing x-ray images electronically instead of using film.

Types:

- Computed Radiography (CR)
 - Digital Radiography (DR)
-

Computed Radiography (CR)

- Uses imaging plates (IP) inside cassettes
- Plate stores energy from x-rays
- Image is processed in a CR reader

Key Points:

- Replaces film but still uses cassettes
 - Requires processing step
 - Uses photostimulable phosphor (PSP) plates
-

Digital Radiography (DR)

- Uses flat panel detectors
- Image appears instantly on computer

Types:

- Indirect DR
 - Converts x-rays → light → electrical signal
- Direct DR
 - Converts x-rays → electrical signal directly

Key Advantage:

- Faster workflow than CR
-

Image Formation Basics

1. X-rays pass through patient
 2. Detector captures remnant radiation
 3. Signal converted to digital data
 4. Image displayed on monitor
-

Exposure Indicator (EI)

- Shows how much radiation reached the detector

Important:

- High EI = Overexposure
- Low EI = Underexposure

Different systems use different EI scales!

Dose Creep

- Gradual increase in patient dose over time
- Happens because digital systems still produce acceptable images even when overexposed

Always use proper technique!

Brightness & Contrast (Digital Terms)

- Brightness
 - Controlled by computer processing (not just mAs)
 - Contrast
 - Controlled by kVp and processing
-

Spatial Resolution

- Ability to see small details

Improved by:

- Smaller pixel size
 - Higher matrix size
-

Pixel & Matrix

- Pixel
 - Smallest unit of a digital image
- Matrix
 - Grid of pixels (e.g., 1024 × 1024)

More pixels = better detail

Bit Depth

- Number of gray shades in an image

Example:

- 8-bit = 256 shades
- 10-bit = 1024 shades

Higher bit depth = better contrast resolution

Histogram Analysis

- Graph showing distribution of pixel brightness

Used for:

- Image processing
 - Determining exposure accuracy
-

Look-Up Table (LUT)

- Adjusts brightness & contrast
- Matches image to body part

Windowing

- Adjusts image after exposure

Types:

- Window Width (WW)
 - Controls contrast
- Window Level (WL)
 - Controls brightness

Artifacts in Digital Imaging

Common causes:

- Dirt or dust on plate
- Scratches on CR plate
- Patient movement
- Improper processing

Collimation Importance

- Reduces scatter
- Improves image quality
- Ensures accurate histogram

Poor collimation → incorrect brightness/contrast

Advantages of Digital Imaging

- Faster image processing
- Image manipulation (zoom, adjust contrast)
- Lower repeat rates
- Easy storage & sharing

Disadvantages

- Risk of dose creep
- Expensive equipment
- Over-reliance on post-processing

Key Exam Tips

- mAs still affects exposure (patient dose)
 - kVp affects penetration & contrast
 - EI tells exposure, NOT image quality alone
 - Collimation is critical in digital imaging
 - Digital ≠ no technique errors
-

Quick Memory Tricks

- CR = Cassette + Reader
- DR = Direct + Rapid
- EI = Exposure Indicator (dose clue)
- WW = Contrast
- WL = Brightness