APPH 226:
Post Processing and Artifacts

Objectives:

6.4, 7.1, 7.2, 7.3, 9.1, 9.2, 9.3

MRT Program

Patient Demographic Input

- Proper identification of the patient is critical
- Could be impossible to retrieve images if they have not been properly identified
  - Patient Name
  - Facility
  - Identification Numbers
  - DOB
  - Examination Date
  - Accession Number



Window and Level

- Most common image processing parameters
  - Adjustment of brightness and contrast
- Window level
  - Controls how bright/dark the image is
- Window width
  - Controls the contrast of the image
    - Wider = lower contrast
    - Narrower = higher contrast

Shuttering / Masking

- When viewing an image (film/digital), the unexposed edges around the image can be distractingly bright
  - Causing veil glare – interferes with the image reception of the eye
- With digital, automatic shuttering is used to black out the white collimation borders, eliminating veil glare
- Can be manually removed

  and adjusted
- ***This is not meant to replace collimation

Image Orientation

- The way that anatomy is oriented on the CR or the detector
  - This is why technologists need to be particular when positioning
- Image is displayed the way it is read
  - CR cassettes have a label to show techs which side is up
  - Sometimes upside down (ie. Table work in the single detector rooms)

Image Annotation

- Allows additional information to be added to the image
- Film – used to write on the image with markers, place stickers
- Image Annotation function with digital allows selection of preset words, or manual text input
- **Should never be used as substitute for marker placement

Magnification

- Two types
  - Magnifying glass function
    - A box placed over a section of anatomy shows a magnified version of that section
    - Just like using a magnifying glass to enlarge just one area
  - Zoom function
    - Enlarges the entire image, so that likely it will not be able to fit on the screen – only a portion will be visible at a time
    - Need to use mouse to navigate the image

Spatial Frequency Filtering

- After signal is obtained for each pixel, to shorten the processing time and minimize storage requirements, the signals are averaged
  - One pixel will be averaged with the signals of the neighboring pixels
- If more pixels are involved in the averaging, the image will appear smoother
- Edge enhancement is when fewer pixels are used for the averaging
  - The fewer pixels are included in the average, the greater the enhancement is

Spatial Frequency Filtering

- High Pass Filtering
  - When frequencies are amplified
  - Sharpening effect
  - Increases contrast and edge enhancement
- Low Pass Filtering
  - When frequencies are suppressed
  - Smoothing
  - Can lose small details, reduces noise and contrast

Image Stitching

- Special cases where the anatomy/area of interest is too large to fit on one cassette
- Multiple images are 'stitched' together to create one image
  - Usually 3-4 CR cassettes used
  - Software program processes image to display as one single image
- Eliminates need for 3-foot films – previously used in film/screen radiography
- Examples: leg length, scoliosis exams

Artifacts

- Any undesirable density on the processed image
  - Excluding scatter/fog
- Four main types:
  - Imaging plate artifacts
  - Plate reader artifacts
  - Image processing artifacts
  - Printer artifacts

Imaging Plate Artifacts

- Usually due to aging or wear
- Plate can become prone to cracks due to the constant removal and replacement within the reader
  - Cracks will appear as areas of radiolucency on the image

Imaging Plate Artifacts

- Techs need to be careful about what goes onto the cassettes
  - Adhesive tape can also leave residue on the cassette

Imaging Plate Artifacts

- Other Artifacts:
- Static
  - Causes things to stick inside the IP
  - Hair/dust can cling to the plate and be visualized on image
- Backscatter
  - Worn down or cracked areas of the lead coating on the cassette allow scatter to reach IP
    - Backscatter can be seen as dark line artifacts

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Image Processing Artifacts

- Can occur for different reasons
  - Incorrect part selection
  - Incorrect sampling
- Very important to set appropriate facts and choose the correct body part so that the algorithm can produce the desired image
- Poor technique and positioning can cause misrepresentation of the image

Plate Reader Artifacts

- If there are extraneous line patterns that appear randomly (not regularly), this can be caused by issues with the electronics
  - requires possible replacement of the electronics
- White lines parallel to the direction of plate travel are caused by debris on the light guide
  - Requires cleaning or replacement by service personnel

Plate Reader Artifacts

- If multiple IPs are loaded into a single cassette
  - Very rare
  - Only one plate will be extracted, leaving the other one to be exposed multiple times
  - Similar effect as double exposing a film cassette
- Insufficient erasure can result in residual information being on the IP before the next exposure
  - Can occur from over exposure or if the erasure lamp requires work

Plate Reader Artifacts

- Moiré artifact can occur with the orientation of a stationary grid
  - Grid lines need to be perpendicular to the laser scan direction
  - Not an issue with moving grids

Printer Artifacts

- Fine white lines may appear on the image due to debris in the laser printer
- This needs to be addressed by service personnel, likely just a cleaning is required

Operator Error

- Aside from equipment causing artifact, human error is a major contributor to artifacts on images
    - Collimation
    - Cassette Use
    - Technical Factors

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Operator Errors

- Collimation
  - Inappropriate collimation for the body part can result in an improper calculation of the exposure indicator, affects histogram
- Cassette orientation
  - If the image is taken on the back of the cassette, there will be artifact from the hardware present on the back
- Technical factor selection is critical to ensure image quality
  - Under exposure produces quantum mottle
  - Over exposure reduces contrast

Operator Error

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Flat Panel Artifacts

- Dead Pixels
  - Manufacturing of the pixels and the array are so complex that it is conceivable that it may suffer some damage
    - Can be caused by dust, scratches, static, chemicals
  - Pixels can be malfunctioning or dead (no function at all)
  - As detectors age, quantity of dead pixels increases, but may not need replacement if they are near edge
  - Software identifies dead pixels and uses an interpolation method to ‘fill in’ the dead pixels with information from surrounding pixels
    - Can be an issue if there are too many dead pixels

Flat Panel Artifacts

- Incorrect Gain Calibration
  - Gain calibration is used for the correction of flaws in the detector
  - If there is an area with many dead pixels or poor connections between the conversion layer and the array – there will be a noticeable artifact on the screen
    - Gain calibration corrects this
    - Creates a mask of the defects, so when an image is taken, the software uses the mask to remove the unwanted densities so only the diagnostic information is displayed

Image Lag

- Some flat panel systems allow the user to take images faster than the detector can accommodate
- If there is an image taken before the detector has finished releasing all the signal for the previous image, there may be a faint image of the previous image still visible
- Like a type of double exposure
  - Caused by:
    - Taking images in rapid succession
    - Over exposure
    - Areas with little beam attenuation (marker)

Offset Correction

- Offset correction can correct image lag
- Determines the amount of signal inherent in the detector
  - Creates a mask of the residual signal
- If this is done before residual signal has left the pixels, that information can be stored as inherent and cause a negative image of the signal – inverse image

Readings

Digital Radiography and PACS 2nd Edition

pg 42-51

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Radiologic Science for Technologists 11th Ed

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