CR DR PAPER (FINA TERM)

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Q1: Describe the features of pre processing and post processing.

PREPROCESSING:

A principal advantage of digital radiography over screen film radiography is ability to manipulate the image before display - preprocessing and after display post processing.

Preimage processing and post image processing after image appearance, usually for purpose of improving image contrast.

Preprocessing of digital images is largely automatic.

Preprocessing is designed to produce artifact free digital image.

In this regard, preprocessing provides electronic calibration to reduce pixel to pixel, row to row, and column to column response differences.

The processes of pixel interpolation, lag correction and noise correction are automatically applied with most system.

Offset images and gain images are automatic calibration images designed to make the response of the image receptor uniform.

Gain images are generated every few months and offset images are generated times each day. These preprocessing calibration techniques are identified as flatfielding.

Averaging ~~techniques~~ techniques also are used to reduce noise and improve contrast.

Digital image receptors and display devices have millions of pixels, therefore, it is reasonable to expect some individual pixels to be defective and to respond differently or not at all. Such defects are corrected by signal interpolation. The response of pixels surrounding the defective pixels is averaged and that value is assigned to defective pixel.

Each type of digital image receptor generates an electric latent image that may not be made visible completely. What remains is image lag and this can be troublesome when one is switching from high dose to low dose techniques.

Some voltage variations may be seen along buses that drive each pixel. This defect is called line noise, can cause linear artifacts to appear on final image. The solution is to apply a voltage correction from row or column of pixels in dark, unirradiated area of image receptor.

POST PROCESSING:

Postprocessing is where digital images shine, In contrast to preprocessing, which is largely automatic post processing requires intervention by the radiologic technologist and radiologist.

Post processing refers to anything that can be done to a digital radiographic image after it is acquired by imaging system.

Postprocessing of digital radiographic image is performed to optimize the appearance of image for the purpose of better detecting pathology.

Annotation is the process of adding text to an image. It is often helpful in informing the clinician about anatomy and diagnosis.

Digital images have a dynamic ranges up to 16-bit, 65,536 gray levels. However, human visual system can visaulize only approximately 30 shades of gray. By window and level adjustment the radiologic technologist can make all 65,536 shades of gray visible. The amplification of image contrast may be most important feature of digital radiography.

The larger matrix size digital display devices have better spatial resolution because they have smaller pixels. This allows among other properties, magnification in digital imaging is similar to using a magnifying glass with a film image.

At times, multiple digital images must be flipped horizontally or vertically. This process is called image flipping. brings images into standard viewing order.

Subration of digital radiographic

images obtained months apart, temporal subtraction - is used to amplify changes in anatomy.

Misregistration of subtraction occurs when the patient moves during serial image acquisition. This can be corrected by reregistering the image through a technique called pixel shift.

Greater use of being made of quantitative imaging that is use of numeric value of pixels to help in diagnosis. This requires identifying a region of interest and compiling the mean pixel value of ROI

Edge enhancement is effective for fractures and small high contrast tissues. Highlighting can be effective in identifying diffuse, non focal disease. Pan, scroll and zoom allow for careful visualization of precise regions of image

Q2: Distinguish between spatial resolution and contrast resolution

SPATIAL RESOLUTION:	CONTRAST RESOLUTION:
① Spatial resolution is ability of an imaging system to resolve and render on the image a small high contrast object.	Contrast resolution is the ability to distinguish many shades of gray from black to white.
In medical imaging spatial resolution is described by quantity, spatial frequency.	All digital imaging systems have better contrast resolution than screen film imaging
Spatial frequency is expressed in line pair per millimeter	The principal description for contrast resolution is grayscale.
A low spatial frequency represents large objects and	Dynamic range is number of gray shades that

and a high spatial frequency represents small objects.	an imaging system can reproduce.
An imaging system with higher spatial frequency has better spatial resolution	The dynamic range of digital imaging systems is identified by bit capacity of each pixel.

3: Discuss the characteristics of digital imaging that should result in lower patient radiation doses.

DOSE REDUCTION WITH DIGITAL RADIOGRAPHY:

1. Exposure should not be repeated in digital radiography because of ~~brightness~~ or contrast concerns.

2. DR systems cannot compensate for excessive noise caused by quantum mottle.

3. Overexposed images do not have to be repeated or should not become a habit.

4. Digital imaging techniques must be approached differently instead of dose creep technique creep should be use with each of the various digital imaging system. The result will be patient radiation dose reduction.

5. Because digital image is unrelated to dose, kVp becomes less important. When digital examination of specific anatomy is conducted, the kVp should start to be increased and an accompanying reduction in mAs should be noted with succesive examinations. The result will be adequate contrast resolution, contrast spatial resolution and reduced patient radiation dose.

Q4: Discuss features of an active matrix liquid crystal display.

FEATURES OF ACTIVE MATRIX LIQUID CRYSTAL DISPLAY:

We all know that matter takes the form of gas, liquid or solid. A liquid crystal is a material state between that of liquid and a solid.

A liquid crystal has the property of highly ordered molecular structure - a crystal - and the property of viscosity - a fluid.

Liquid crystal materials are linear organic molecules that are electrically charged, forming a natural molecular dipole. Consequently the liquid crystal can be aligned through the action of an external electric feild.

Active matrix liquid crystal displays are superior to CRT displays.

Q5. Identify application of the picture archiving and communication system

PICTURE ARCHIVING AND COMMUNICATION SYSTEM:

Radiology is adopting digital imaging very rapidly. Estimates of present level of digitally acquired images ranges upto 90%.

A picture archiving and communication system when fully implented, allows not only acquistion but also the interpretation and storage of each medical image in digital form without resorting hard copies (films). The project efficiencies of time and cost are enormous.

PACS improves image interpretation, processing, viewing, storage and recall.

The four principal components of PACS are image acquisition system, the display system, the network and the storage system.

Q6: Discuss three types of digital radiography artifacts and how to avoid them.

ARTIFACTS OF DIGITAL RADIOLOGY

There are 3 types of artifacts in DR as follows.

Image receptor artifacts:
Digital image

receptors can suffer from rough handling, scratches and dust,

Artifacts produce by dust can be corrected easily with proper cleaning unless dust is internal to optics of a computed radiography imaging system.
we can avoid it by:
If a CR IP not been used for 24 hours, it should be erased again before use.

When completely erased IP is processed, the resultant should be uniform and artifact free.

Software artifacts:

Digital radiographic images are obtained as raw data sets.

As such these images are ready for processing.

It includes histograms, range scaling, image compression

It can be avoided by:

If CR cassette has not been used for several days, it should be inserted into the reader for re erasure.

Object artifacts:

It includes patient position, collimator (partition and backscatter.

Back scatter radiation also can be troublesome because of the sensitivity of the digital radiographic image receptor.

It can be avoid by:

using accurate patient positioning, appropriate collimation and ~~not~~ ~~to~~ prevention of back scatter.

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Q7: Discuss the basis for data compression and the difference between loseless and lossy compression

DATA COMPRESSION:

Data compression takes of redundacy of data, as occurs with exposure to the raw x ray beam when all values are the same such compression techniques are described as loseless or lossy

LOSELESS COMPRESSION:

An image file that is compressed in a loseless mode is one that can be reconstructed to be the exactly the same as the original image. Loseless compression reduces the data file to 10% to 50% of the original file.

Loseless compression upto 3:1 generally is considered acceptable and helpful in digital radiographic image management.

LOSSY COMPRESSION:

Lossy compression which can provide compression factors upto 100:1 or greater, can be used on images in which exact erasure management or fine detail is not required, such as video standard domestic television,

Lossy compression is that which is something greater than an order of magnitude compression less than 10:1.

Such a level of compression supports teleradiology but not computer aided detection or image archiving.

Q8) Identify the difference between for processing and for presentation images:

FOR PROCESSING AND FOR PRESENTATION IMAGES:

For processing images are manipulated into for presentation images that the radiologic technologist can use for QC and interpretation by the radiologist.

Before an image is prepared "for processing" several manipulations of output of an image receptor may be necessary to correct for potential artifacts. Such artifacts can occur because of dead pixels or dead rows or columns of pixels.

For processing:
Raw image data before proprietary processing. (Raw data is transferred to a for processing image.

For presentation:

After some has been gained or is the image that is intended for viewing.

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Q9: Explain how digital radiographic image artifacts occur because of improper collimation partition or alignment.

Collimation and partition:

Ans If the xray exposure feild is not properly collimated, sized and positioned, exposure feild recognition errors may occur. The result is very dark or very light or very noisy image.

Automatic radiation feild recognition is essential for artifact free images.

Collimation of the projected area xray beam is important for patient radiation dose reduction and for improved image contrast in screen film radiography.

In DR, proper collimation has the added value of defining image histogram. If improperly collimated, the histogram can be improperly analyzed resulting in artifact.

Proper collimation and centering prevent histogram errors that can lead to artifacts.

If multiple feilds are projected onto single IP, each must have clear, collimated edges and margins between each feild. This process is called partitioning.

Partitioning of multiple digital images on a single IP results in proper separation and collimation of each image.

Alignment:

Alignment of exposure feild on IP is also important as collimation. When an image feild is not oriented with the size and dimensions of the IP, image artifacts can appear.