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Bs RADIOLOGY 4<sup>TH</sup> SEMESTER

ASSIGNMENT CR DR

Question No. 1

## DIGITAL SUBTRACTION ANGIOGRAPHY

The portuguese neurologist Egas Moniz in 1927 developed the technique of contrast x-ray cerebral angiography to diagnose disease. Such as tumors and arteriovenous malformation.

The idea of subtraction images was first proposed by the Dutch radiologist Ziedses des planters in 1935 when he was able to produce subtracted images using plain films.

DSA The acquisition of digital fluoroscopic images combined with injection of contrast material and real time subtraction of pre and post contrast images to perform angiography is referred to as digital subtraction angiography.

Digital subtraction angiography is a

Fluoroscopy is a technique used in interventional radiology to clear visualize blood vessel in bony or dense soft tissue environment.

- Images are produced using contrast medium by subtracting a "pre contrast image" or mask from subsequent image.
- Once the contrast medium has been introduced into a structure. Hence the term "digital subtraction angiography".
- Subtraction angiography was first described in 1935 and in English source in 1962 as a manual technique.
- Digital technology made DSA practical from the 1970s.

## INDICATIONS:

There are numerous indications for angiography and their number has been on the rise ever. Since interventional radiology has been shown to successfully supplant many open vascular procedure.

- Some examples include.

- ⇒ endovascular aneurysm repair
- ⇒ arterial balloon angioplasty
- ⇒ arterial stenting
- ⇒ endovascular embolisation
- ⇒ thrombectomy

## CONTRAINDICATION:-

Renal insufficiency and hypersensitivity to iodinated Contrast media are relative Contraindications. Some Centers use Carbon dioxide as a Contrast agent for these cases

## PROCEDURE:-

### PREPROCEDURAL EVALUATION:-

Patient evaluation should include, but is not limited.

- ⇒ Presence of atherosclerotic disease (myocardial infarction)
- ⇒ Diabetes.
- ⇒ Medications.
- ⇒ allergies and previous exposure to iodinated Contrast media. etc.

## DSA TECHNIQUE:-

Digital subtraction angiography is used to produce images of the blood vessels without interfering shadows from overlapping tissues.

This provides a clear view of vessels and allows for a lower dose Contrast medium.

The non Contrast image (mask image) of the region is taken before injecting

Contrast material and therefore only show anatomy, as well as radiopaque foreign bodies (surgical clips & stents) as would a regular x-ray image.

Contrast material is being injected. These images show the specified vessels superimposed on the anatomy and are stored on the computer.

The mask image is then subtracted from the contrast images pixel by pixel. In result subtraction images show the filled vessels only.

Recording can continue to provide sequence of subtracted images based on the initial mask.

The subtraction images can be viewed in real time. Even if the lies still there is bound to be some degree of misregistration of images due to movement between the acquisition of the mask image and the subsequent contrast images.

The effect is prominent at high contrast interfaces, such as bone soft tissue, metal staples and coils and

- it should be noted that since image subtraction causes a decrease in signal to noise ratio.
- The subtraction image appear noisier than the source images
- The inevitable solution to this is to increase mA.

## COMPLICATIONS:-

Complications can be better categorized into local and systemic complications.

### Local Complications:-

- \* From the puncture site
- \* Thrombus formation
- \* local tissue damage.
- \* arteriovenous fistula.

### SYSTEMIC COMPLICATION:-

- \* Thromboembolism
  - \* air embolism
  - \* Vessel dissection
  - \* Contrast mediated nephrotoxicity
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## Question No. 2

### ARTIFACTS IN DIGITAL RADIOGRAPHY:-

- Artifact is defined as an opacity on the radiograph which does not correspond to an actual anatomic structure.
- Any thing decreasing radiographic quality.
- An artifact is any false visual feature on a medical image that stimulates tissue or obscures tissue.
- Common artifacts in digital radiography are

### IMAGE RECEPTOR ARTIFACTS :-

- Digital image receptors can suffer from rough handling, scratches and dust, pixel malfunction, ghost image.
- Artifacts produced by dust can be corrected easily with proper cleansing.
- Dust on any section of the CR optical path mirrors and lenses cannot be corrected by the radiologic technologist.
- Environment artifacts can contribute

to ghost artifacts. *6.01 notes*

- The appearance of ghost images occurs because of incomplete erasure of a previous image on CR IP. Such artifacts can be corrected by additional signals erasure techniques.
- CR IP has not been used for 24 hours it should be erased again before use.
- Rough handling or faulty construction of digital IP construction of digital image plate can result in artifacts.
- Rough handling can be avoided by technologists.

## SOFTWARE ARTIFACTS:-

Histograms Range/Scaling image  
Compression

- Digital radiographic images are obtained as raw data sets these images are ready for processing.

Before an image is prepared for processing of the 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.
- A single pixel or a single row or column will not interfere with diagnosis. Many of these defects must be corrected.
- Flat fielding software, interpolations, manipulation of output of an image receptor may be necessary to correct the artifacts.

## OBJECT ARTIFACTS:-

- Patient positioning, collimator partitions, backscatter these artifacts can arise from technologist errors.
- If a lot of scattering material is present behind the image receptor backscatter radiation can cause a phantom image. If this type of artifact is discovered, the back side of the image receptor should be shielded to reduce backscatter x-rays.
- Proper collimation and centering prevent histogram errors that can lead to artifacts.

## Question No. 3

### DISADVANTAGES OF DIGITAL

#### RADIOGRAPHY:-

- One of the main disadvantage of digital radiography is high start up cost but this is accepted due to the long term benefits of the system and recouping costs overtime.
- Need a Computer or network.
- Medicolegal:-  
The ability to manipulate the images for fraudulent purposes.
- CROSS-INFECTION CONTROL:-  
The intraoral sensor cannot be sterilized.
- Sensor Dimension:-  
The sensor is bulky in size.
- Any exposure to radiation, no matter how small, has the potential to cause harmful biologic changes.
- Can cause permanent damages to living cells and tissues.
- Genetic Mutation
- Can cause cancer.

## Question No. 4

Image quality of Screen film radiography  
or digital radiography

### SCREEN FILM RADIOGRAPHY

over or underexposure and poor equipment maintenance commonly result in poor radiographic quality of screen film radiography.

Screen film radiography have high spatial resolution.

Screen film has a much narrow latitude to get correct exposure, so a small change in photon energy has a greater impact.

More radiation needed to produce the same quality image as film.

### DIGITAL RADIOGRAPHY

In digital radiography less depend on exposure setting or maintenance. This is due to wider dynamic range, which allow a wide range of exposure factor.

Digital radiography low spatial resolution.

Digital radiography has greater exposure latitude, so image is still acceptable with small change in photon energy.

Less radiation needed to produce the same quality <sup>image</sup> as film (Digital x-ray gives 70% less exposure to radiation than conventional x-rays).

In Screen film radiography 16 to 25 shades of grey. Image quality of screen film radiography is less better than digital radiography because screen film radiography have less shades of grey.

Image format:-

Analog

In digital radiography has 256 shades of grey. Image quality of digital radiography is more better than screen film radiography because digital radiography has more shades of grey than screen film radiography.

Image format:-

Digital discrete pixels

Time to image:- 10-30min

Time to image:- 10-30min  
Seconds or less

Image storage:-

Physical

Image storage:-

Electronic

Digital radiography can be valuable and affordable imaging technique that can offer some advantage over screen film radiography.

Image quality of digital radiography is better than screen film radiography.

image quality of Digital radiography is "Superior" than Screen film radiography.

### Question No. 5

Difference between image receptor used in Conventional radiography and Digital radiography.

### IMAGE RECEPTOR USED IN DIGITAL RADIOGRAPHY:-

image receptors used in Digital radiography are charge electronic device CCD, Flat panel, PSP, CMOS.

Digital image receptor is a device that intercepts the x-ray beam after it has passed through patient body produced an image in detail form a matrix of pixels each with a numerical value. it replaces the Cassette containing intensifying screens and films used in conventional film Screen radiography.

Digital image receptor is a form of a matrix of individual pixel elements which work based on certain technology like solid state technology and photostimulable plate

technology.

- When pixel area exposed by x-rays beam. x-ray photon core absorbed and energy produces an electrical signals.
- These signals in the form of analog data that is then convert to digital number and stored as one pixel an image.

Three types of solid sensor are used CCD, CMOS, and thin film transistor.

- Photo stimuable phosphor consists of a phosphor coated on top of a plate in which the latent image is formed after x-ray exposure.
- Latent image is converted to a digital image by a scanning device through stimulation by laser light. it is also refers as storage phosphor on the basis of the motion. image formation is temporary is stored with in the phosphor.

## IMAGE RECEPTOR USED IN CONVENTIONAL RADIOGRAPHY:-

The receptor used for most radiographic procedures contains

two intensifying screens mounted on each side of double-emulsion film using two screens in this manner increase x-ray absorption and receptor sensitivity with least amount of image blurring.

Direct action of non screen film sensitive primarily to x-ray photon.

Indirect action or screen film. it is used in combination with intensifying screens in a cassette.

This type of film is sensitive to light photons which are emitted by the adjacent intensifying screens.

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