NAME: HAMID ULLAH

ID : 14603

VIVA: CR&DR

Q1: What is digital subtraction angiography? Explain

Ans: **Digital Subtraction Angiography**

Definition

Digital subtraction angiography (DSA) is a diagnostic procedure that allows a physician to visualize blood vessels through use of contrast media and digital computer imaging.

Purpose

Angiography is a technique of producing pictures (angiograms) of internal structures by introducing dye (contrast media) into the circulatory system that show up on x-ray film when tissue is exposed with x rays.

The difference between DSA and traditional angiography is that with DSA two digital pictures of the tissue are taken. The first is made before the dye is introduced. The second is made after the dye is injected. A computer then removes, or subtracts, certain structures in the first picture from those in the second picture. This leave an angiogram that shows only the blood vessels and omits surrounding or background tissues.

DSA is used to detect blood clots, tumors, and other blockages in blood vessels and some ducts. The procedure is also used to examine the health of blood vessels after coronary artery bypass or other vessel grafting operations. Sometimes other procedures are performed during a DSA such as inflating a small balloon in an artery to unblock it (angioplasty), placing a stent, or metal mesh to hold an artery open, opening a blocked bile or duct, inserting a drainage tube into a blocked kidney duct, and inserting a pacemaker device in the chest. During this time, the image serves as a guide to the physician performing the procedure.

Precautions

DSA is not a risk-free procedure. Individuals who are allergic to iodine or iodine-containing foods such as shellfish may have an allergic reaction to the contrast medium. This reaction can be severe and may cause difficulty breathing, A sudden drop in blood pressure, loss of consciousness, tissue swelling, and other symptoms of anaphylactic shock. If DSA (or any other angiogram) is recommended, patients should inform their physician of any allergies to food and medicines. Also, since the contrast dye is removed from the circulatory system by the kidneys and excreted in urine, the dye may put an additional burden on poorly functioning kidneys. People with reduced kidney function should discuss this with their physician.

Description

During digital subtraction angiography the individual lies on a table. Electrodes are placed on the chest to monitor heart health throughout the procedure. An x ray of the area is taken before the dye is injected. Next, a local anesthetic is injected into the skin at the site where the dye will be introduced. A thin tube is then inserted into the blood vessel, and the dye is injected. Additional x-ray pictures are then taken that show the dye in the blood vessels. The computer subtracts structures in the first picture from those in the second picture almost instantaneously, leaving an uncluttered picture of the blood vessels of interest. DSA without any

additional procedures can take as little as 30 minutes. If additional procedures are needed, the time can stretch to 3 hours.

Preparation

No special preparation is needed for a DSA alone. If other procedures are to be performed, the physician will give specific instructions on preparation.

Aftercare

After the DSA, the individual needs to lie still for about 6 hours to prevent bleeding. During this time the individual will be monitored for complications. Depending on the appearance of complications, health of the individual, and any additional procedures performed, an overnight stay in the hospital may be necessary.

Complications

In addition to allergic reactions to the dye, complications include damage to the artery by the tube used to inject the dye. In addition debris on the artery wall (plaque) can be dislodged by the procedure and block the artery. Blockage can cause stroke, heart failure, or tissue damage.

Results

A DSA should provide a clear picture of the blood vessels of interest. Should the picture be inadequate to make a definitive diagnosis, other tests can be performed. These include a traditional (non-subtraction) angiogram, duplex sonography, or a magnetic resonance angiogram (MRA).

Q2: What are common artifacts in DR? How will you avoid them

Ans: **ARTIFACTS**

• Any undesirable objects OR structures recorded on the radiography image cause degraded image quality.

• Produced from:

- Patients such as motion, poor preparations

- Technologists such as less knowledge, less training

- Machines, there are various artifacts from CR and DR radiography machines.

Noisy Detector Power Supply Artifacts

- **Appearance:**

Vertical lines, which are symmetrical around the center of the image.

- **Cause:**

Caused by a noisy detector power supply

- **Solution:**

Replace power supply

Loose Cone Artifacts

- **Appearance:**

White edges.

- **Cause:**

Cone has fallen out of the x-ray tube port and is blocking the collimator from opening.

- **Solution:**

Remove the collimator and re-attach the cone to the tube port

Bar code Artifacts

- **Appearance:**

Barcode appear on screen

- **Cause:**

Cause by a failure in a data module or the detector

- **Solution:**

Perform bad pixel calibration, if calibration fail then replace detector

Double Exposure Artifacts

- **Appearance:**

Duplication of images

- **Causes:**

Two subsequent exposure on same imaging plate

- **Solution:**

Proper knowledge of using of X-ray equipment

Poor Collimation Artifacts

- **Appearance:**

Unsharp images

- **Causes:**

Improper collimation

- **Solution:**

Proper collimation in accordance with cassette size and body part

Improper Exposure KV Artifacts

- **Appearance:**

Darkening or whitening of image

- **Causes:**

Improper exposure setting

- **Solution:**

Proper exposure factors to be used based on body part and patient size

Scratches Artifacts

- **Appearance:**

Kink marks on the image

- **Causes:**

Mishandling of imaging plate during cleaning process

- **Solution:**

Cassettes and image plates should be handled with care

Light Bulb Artifacts

- **Appearance:**

Darkening of lower and outer portions of an image

- **Causes:**

High exposure, back scattered radiation entering imaging plate from patient's bed due to increased exposure for obese patients or due to uncollimated x ray

- **Solution:**

Reduce back scatter by lowering the KV or proper collimation.

Dust Artifacts

- **Appearance:**

Focal radiopacities

- **Causes:**

Dust particles wedged over imaging plate

- **Solution:**

• Regular cleaning of imaging plates with proper cleaner

(Ethyl Alcohol).

• Paper towels or gauze should not be used because they leave fibers on

the plate, the use of lint-free cloth is advisable

Disparity Artifact

- **Appearance:**

Defective scanning resulting in alteration in image contrast, lower half of it was

exposed to laser beam for longer time, which resulted in brighter image output

- **Causes:**

Malfunctioning of rollers in CR reader

- **Solution:**

• Periodic cleaning of roller in CR reader by the supplier

• Optimal image

Q3: What are disadvantages of DR?

Ans: **DISADVANTAGES OF DR:**

Any exposure to radiation, no matter how small, has the potential to cause harmful biologic changes

- Can cause permanent damage to living cells and tissues
- Genetic Mutation
- Can cause cancer

Critical Organs

- Skin
- Thyroid Gland
- Lens of the Eye
- Bone Marrow

Digital radiography is a form of X-ray imaging, where digital sensors are used instead of tradition photographic film.

- Poorer spatial resolution.
- Artifact due to imaging plat, image processing algorithm etc
- Non available of post-processing functions
- Increased sensitivity to scattered radiation
- More expensive than screen film radiography
- Whilst underexposure will give us a grainy appearance, overexposure is automatically corrected by imaging software so there is tendency to overexposure to ensure a good quality image.

- One of the main disadvantages of digital radiograph is the high start-up cost but generally this is accepted due to the long term benefits of having the system and recouping costs over time.
- With computed radiograph system, images need to be processed almost immediately as any delay will result in loss of image information due to trapped electron returning to a lower energy state. This tend to be a problem in field radiography where image are required away from the practice.

Q4: Compare the image quality of screen film radiography and DR, which one is superior?

Ans: **IMAGE QUALITY DIFFERENCE**

Whenever we compare the image quality of both system, there is a small differences in both systems resulting image quality and diagnostic. Some of them are discussed below.

SCREEN FILM RADIOGRAPG

1. Taking about screen film, the system has higher spatial resolution compared to digital. But the image quality may get lower due to the poor maintenances of equipment and operator or technologist error.
2. If we try to get a high contrast image, then we may get a gray scale image. Because of the inverse relationship between latitude and contrast.
3. Image quality also suffer due to some factor like type of film used, the exposure factor and more important the processing and the radiograph.
4. This system has low dynamic range because of which its image quality suffer compared to the digital image quality.

5. Exposure factor need to be set carefully otherwise you would get extremely get bad image quality.

Image quality reduction due to operator:

Film fogging marks on the film, dust and interfere with the image quality of radiograph. This factor can be controlled by the operator.

DIGITAL RADIOGRAPH

1. Digital radiograph is one of the advance technological revolution in image system
2. It has a lower spatial resolution compared to the screen film. But it can image the final image quality better then the screen film.
3. Because of less depend on the exposure factors, digital system.
4. Digital radiograph has depend relationship between the latitude and contrast unlike the screen film radiograph which result in giving a high contrast image.
5. The dynamic range of the digital system are quite higher if we compare it with the screen film, which result in higher image quality.
6. Exposure factors have less effect on the final attitude and contrast of image.

Image quality reduction due to operator

- Severe overexposure can result in loss of information which can result in lower image quality.
- Under exposure can result in grainy and mottled images due to low number of photons.
- Film fogging can occur if the image plate is not erased properly.

- Debris, hair or any other small things in the CR cassette can cause artifacts.

WHICH ONE IS SUPERIOR:

Looking at the above point clarifies that the digital radiograph image quality is way superior then the conventional radiograph.

Digital radiograph is very affordable and valuable imaging system which offer some advantages over screen film radiograph.

The operator must be aware of its limitations.

The use digital radiograph, the operator or technicians would have to be familiar with the system, commonly occurring artifacts and all the principal of image processing of this system.

One important thing is to note that image quality can be affected by the operator mostly in digital system.

Q5: What are the differences between image receptors used in conventional radiography and digital radiography?

Ans: CONVENTIONAL RADIOGRAPHY

Conventional radiograph is the x-ray used for the internal structure of the body.

Just like the other modality of radiograph, it is also has x-ray source which emit x-ray and a receptor which receive or capture the x-ray which exit the patient.

IMAGE RECEPTOR

Conventional radiograph image receptor consist of the following part;

1. Radiographic film
2. Intensifying screen

They are used as an image receptor in combination, but there are some procedure or cases in which there is no use of the intensifying screen. And the film is exposed to the radiation.

RADIOGRAPHIC FILM

The radiographic film required tight quality control. The slightest thing or contamination can result in misrepresentation of the structure or loss of information. The film are made in darkness.

Radiographic film has the following component:

1. Base
2. Emulsion
3. Adhesive layer
4. Gelatin layer

The emulsion is coated on each side of the base unit in some films, there is only one emulsion coated on a side of base.

ADHESIVE LAYER:

The layer is present between the emulsion and base of the film and it act as a glue between the emulsion and base. Sticks both with each other.

GELATIN LAYER:

this is a protective covering layer on the emulsion. Act as a protection layer and protects the emulsion from scratches.

BASE:

1. Foundation of radiographic film
2. The base is made up of polyester
3. It provide rigid structure to the film
4. It is flexible
5. Fracture resistance
6. It is semi-rigid
7. Lucet (Transparent for x-rays)
8. Thickness is 150 to 300 micrometers

EMULSION:

The emulsion is know as the heart of the radiographic film. That's the material with which the light or x-ray photon strickes. And the formation of the latent image occur in emulsion.

Gelatin:

1. Similar gelatin is used like one which is found in desert and salads.
2. Clear and lucent to like photons.
3. Porous for chemicals to pass through it during process.
4. It provide mechanical support to silver halide.

Silver halide:

1. Active component of the emulsion.
2. 98% silver bromide and 2% is silver iodide are present in emulsion.
3. Having high atomic number
4. Interaction of x-ray photon with this high atomic compound result in the production of latent image.
5. The crystal are presents in various shape like tubular, cubic etc.
6. The concentration and size of crystal determine the speed of film.

INTENSIFYING SCREEN:

1. Intensifying screen are thin sheets, or layers.
2. They are kept in the x-ray cassette with the radiographic film.
3. It decrease the patient dose. As it decrease the mAs.
4. Reduce the motion blur.
5. Reduce the exposure time and hence reduce the x-ray tube loading.
6. Two screen are used with those film who use double emulsion, in the cassette.
7. The intensifying screen thickness is about 0.4mm.
8. Thickness the screen is improved speed will be.
9. Thickness the screen is reduced spatial resolution will be.

Layers:

Following are the intensifying screen layers;

1. Base
2. Reflecting layer/absorptive layer
3. **Phosphor:**

Conversion of x-ray photons to visible light occur here.

- Gadolinium: green light
- Lanthanum: blue light
- Yttricum

Spectral matching:

We should must take care of the spectral matching that the wavelength of the light emitted must be the same or must watch of light to which of the film is sensitive.