1.3.1 Fluoroscopy

Fluoroscopy is a medical imaging technique that allows doctors to see the inside of the body in real time. It's similar to an X-ray movie, with a continuous X-ray beam passed through the body and displayed on a monitor.

Fluoroscopy can be used for a variety of purposes, including:

- **Diagnosing health problems**

  Fluoroscopy can help identify the cause of health issues like heart or intestinal disease.

- **Guiding treatments**

  Fluoroscopy can help guide procedures like implants, injections, or orthopedic surgery.

- **Examining specific body parts**
  Fluoroscopy can be used to examine bones, muscles, joints, and solid organs like the heart, lungs, and kidneys.

Fluoroscopy uses X-rays, which are a form of ionizing radiation, so it poses some health risks. The total time of the fluoroscopy procedure is a major factor in determining the patient's exposure to radiation. Pregnant patients should discuss the risks with their doctor before undergoing a fluoroscopy procedure.

The images produced by fluoroscopy are inverted grayscale, meaning black and white are reversed. This is a convention that originated with early fluoroscopic screens and has been retained even though it's possible to digitally reverse the grayscale.

1.3.2 ANGIOGRAPHY

Blood vessels do not show clearly on a normal X-ray, so a special dye called a contrast agent needs to be injected into your blood first.

This highlights your blood vessels, allowing your doctor to see any problems.

The X-ray images created during angiography are called angiograms.

Why angiography is used

Angiography is used to check the health of your blood vessels and how blood flows through them.

It can help to diagnose or investigate several problems affecting blood vessels, including:

- atherosclerosis – narrowing of the arteries, which could mean you're at risk of having a stroke or heart attack
- peripheral arterial disease – reduced blood supply to the leg muscles
- a brain aneurysm – a bulge in a blood vessel in your brain
- angina – chest pain caused by reduced blood flow to the heart muscles

- blood clots or a pulmonary embolism – a blockage in the artery supplying your lungs
- a blockage in the blood supply to your kidneys

Angiography may also be used to help plan treatment for some of these conditions.

What happens during angiography

Angiography is done in a hospital X-ray or radiology department.

For the test:

- you'll usually be awake, but may be given a medicine called a sedative to help you relax
- you lie on an X-ray table and a small cut (incision) is made over 1 of your arteries, usually near your groin or wrist – local anaesthetic is used to numb the area where the cut is made
- a very thin flexible tube (catheter) is inserted into the artery
- the catheter is carefully guided to the area that's being examined (such as the heart)
- a contrast agent (dye) is injected into the catheter
- a series of X-rays are taken as contrast agent flows through your blood vessels

The test can take between 30 minutes and 2 hours. You'll usually be able to go home a few hours afterwards.

Read more about what happens before, during and after angiography.

Risks of angiography

Angiography is generally a safe and painless procedure.

But for a few days or weeks afterwards it's common to have:

- bruising
- soreness
- a very small lump or collection of blood near where the cut was made

There's also a very small risk of more serious complications, such as an allergic reaction to the contrast agent, a stroke or a heart attack.

Read more about the risks of angiography.

Types of angiography

There are several different types of angiography, depending on which part of the body is being looked at.

Common types include:

- coronary angiography – to check the heart and nearby blood vessels

- cerebral angiography – to check the blood vessels in and around the brain
- pulmonary angiography – to check the blood vessels supplying the lungs
- renal angiography – to check the blood vessels supplying the kidneys

Occasionally, angiography may be done using scans instead of X-rays. These are called CT angiography or MRI angiography.

Cineangiography

Cineangiography is a medical imaging technique that uses X-rays to capture a series of images of blood vessels in motion. It's often used to diagnose coronary artery disease and to image the heart's chambers and coronary arteries.

Cineangiography involves injecting a radiopaque contrast into blood vessels and then capturing a series of X-ray images at a high frame rate. The images show the movement of the contrast through the blood vessels, which can help determine how fast blood is traveling.

Cineangiography is considered the gold standard for diagnosing coronary artery disease. It can help:

- Visualize coronary anatomy and stenoses
- Determine the characteristics of a coronary artery lesion

Some common frame rates used in cineangiography include:

- 30 frames per second, which is commonly used
- 60 frames per second, which can be used in some pediatric cases or if the heart rate is greater than 95 beats per minute
- 15 frames per second, which is standard in many adult laboratories

Angiography is an invasive procedure, but it's generally considered relatively safe. However, there are some potential complications, including:

- Contrast reactions
- Bleeding at the injection site
- Infection
- Injury to an artery
- Embolism
- Shock
- Seizures
- Renal failure
- Cardiac arrest

Digital subtraction angiography (DSA)

Digital subtraction angiography (DSA) is a diagnostic procedure to view the inner surface of blood vessels (also known as lumen). It can be used to view arteries, veins and heart chambers.

DSA is a fluoroscopic technique (a technique that captures continuous images) that uses complex, computerised X-ray machines. A special contrast medium or 'dye' is injected into your blood to make the blood vessels easier to see.

Images are taken before and after the contrast dye is injected. To highlight the blood vessels, software is used to digitally 'subtract' the first image from the second.

Why do you need digital subtraction angiography (DSA)?

DSA is used to diagnose:

- **Abnormal connections** between arteries and veins
- **Blood vessel diseases**, including obstructive vascular diseases that are caused by blocks or narrowing in the lumen (inside) of arteries and veins
- **Brain aneurysms** (especially intracranial aneurysms)
- **Bleeding vessels**

It may also be used to:

- Assess the blood vessel systems of cancerous tumours.
- Provide a visual guide for interventional procedures such as angioplasty (ballooning) and vessel stenting.

Who should not undergo digital subtraction angiography (DSA)?

This procedure may not be suitable if you:

- Have poor kidney functions
- Are hypersensitive to the iodinated contrast medium

What are the risks and complications of digital subtraction angiography (DSA)?

DSA is a relatively safe procedure. Complications are rare and may include:

- Allergy to the contrast medium
- Bleeding from the puncture site
- Harmful effects of the contrast medium on other organs (e.g. kidney)

1.3.3 Mammography

Mammography is a medical imaging technique that uses X-rays to examine the breast for cancer and other diseases:

- **How it works**

  During a mammogram, a patient's breast is compressed and an X-ray machine takes images of it. The images are called mammograms and are examined by a radiologist for abnormalities.

- **Benefits**

  Mammography can help detect breast cancer in its earliest stages, when it's too small to feel or detect by other methods. It can also detect benign tumors and cysts.

- **Risks**

  Mammography exposes patients to a small dose of radiation. However, the benefits of early detection outweigh the risks.

- **Types of mammography**

  There are two types of mammography:

  - **Screen-film mammography**: Uses X-rays to create an image on a cassette containing film and a screen.
  - **Full field digital mammography**: Uses X-rays to create a digital image that's sent to a monitor or printer.

- **Where to get a mammogram**

  Mammograms can be performed at breast clinics, hospitals, mobile vans, private radiology offices, and doctors' offices.

  Mammograms are the most common screening method for breast cancer. However, they can also produce false-positive results and lead to overdiagnosis.