

INTRODUCTION

- An **x-ray** image intensifier, is an imaging component which Converts X-rays into a visible image.
- The term [image intensifier](#) refers to a specific component of an x-ray imaging system, which allows low intensity x-rays to be converted to a visible light output.
- The device contains a low absorbency/scatter input window, typically aluminum, input fluorescent screen, photocathode, electron optics, output fluorescent screen and output window.
- This device was originally introduced in 1948

Principles and parts

- A C-arm comprises a generator (X-ray source) and an image intensifier or flat-panel detector.
- The C-shaped connecting element allows movement horizontally, vertically and around the swivel axes, so that X-ray images of the patient can be produced from almost any angle.
- The generator emits X-rays that penetrate the patient's body.
- The image intensifier or detector converts the X-rays into a visible image that is displayed on the C-arm monitor..

Modern imaging systems will use the image intensifier as the source of images supplied to a storage system.

Clinical applications

- As a fixed piece of equipment in a dedicated screening room
- mobile equipment for use in an operation theatre
- It can be processed and print the on going shot pictures within few minutes
- Fluoroscopy delivers a dose of approximately 5 Rads per minute in the direct beam

Components

- C-arm (encompasses the actual X-ray source and image intensifier)
- Table
- Fluoroscopic exposure and program controls
- Post processing software
- Viewing monitors
- Foot control and hand switch
- Connecting cables and power cord



- MONITOR
- IMAGE INTENSIFIER(CAMERA)
- C-ARM
- TABLE WITH PATIENT
- X-RAY SOURCE
- HAND SWITCH
- CONTROL PANEL

C-ARM IMAGE INTENSIFIER

MODERN TYPE WITH VIDEO FLUOROSCOPY

Permanent/Fixed Fluoroscopic Systems

- Two main configurations in permanently installed fluoroscopic systems
 1. One class commonly utilizes a radiolucent patient examination table with an under-table mounted tube and an imaging system mounted over the table
 2. Other is commonly referred to as a C-arm system used where greater flexibility in the examination process is needed such as neuro or cardiac imaging

Permanent/Fixed Fluoroscopic Systems Conti.,

- Modern imaging systems on both configurations are limited .
- All frame rates, storage (local or PACS), image capture devices
- lower in cost than before.
- software configurable and based on COTS components .

The non-C-arm - screening rooms.

The Types of investigations

- Endoscopy studies ([ERCP](#)) (Some sites will opt for a portable C-arm system for this)
Barium studies (swallows, meals, enemas)
- Fertility studies ([HSG](#))
- For diagnosis purpose of the various departments (orthopaedic, neuro, gastro) during emergency

C-arm-portable x-ray machine

The C-arm systems are commonly used for studies requiring the maximum positional flexibility such as

- Angiography studies (peripheral, central and cerebral)
- Therapeutic studies (Line placements .e. *Permacath/Hickman*, transjugular biopsies, TIPS stent, embolisations)
- Cardiac studies ([PTCA](#))
- Orthopedic procedures (ORIF, DHS, MUA, spinal work) - again generally using a portable C-arm maximum flexibility in positional use.
- Intra-operative Urological surgery
- Used in paediatric surgery

General configuration

- A mobile image intensifier has units,
 1. X-ray generator
 2. imaging system on (C-arm)
 3. workstation unit
- used to store and manipulate the images. The imaging system unit can perform a variety of movements that allow for use in a variety of surgical procedures such as cardiology, orthopedics and urology

X-ray Generator

- X-ray generator, dose control system and collimator controls are usually housed in the chassis on which the C-arm is mounted.
- All of the control systems are closed loop systems which are directed by the master controller initial program settings.

Imaging system



IMPORTANT NOTES TO OPERATORS

- Kvp must be appropriate for the study. For C-arms, typically the kVp and ma are adjusted automatically.
- Higher kVp, the scatter radiation is more penetrating.
- Do not override and use kVp much higher than needed
- Use of wrap around style aprons can help. Lead gloves are required if hands are in the primary beam.

CONTINUE.,,

- Cover the C-ARM with sterile sheet or draping that readily available in the market.
- Maintain the sterility during the surgery.
- Don't disturb the surgeon and assistants
- Make sure that door kept closed and all the surgical teams wearing the safety attire or not



SAFETY MEASURES

Lead aprons (shield)

Wear a lead apron during fluoroscopy while using 0.5 mm lead equivalent for fluoro aprons - “wrap around” style aprons are best for persons who need to move about in the room.

Thyroid Shield

- Use of a thyroid shield keeps worker’s radiation

Lead glasses

- For persons who routinely fluoro for long or interventional procedures, lead glasses with side shields can provide additional protection to the lens of the eyes.
- Note that the operator often has to look sideways from the C-arm x-ray tube to see the image on the monitor. This leaves the lens unprotected if glasses do not have side shields

Safety Measures Conti.,

Lead Shield Care

- Hang aprons and shields on racks. Do not bend or fold lead aprons or shields. Folding can cause cracks and tears in the protective material. Periodically inspect shields for evidence of damage. Remove damaged ones from use.
- Don't allow any health workers without wearing safety attires
- Red light or radiation symbols should be there out the room doors

C-ARM READY FOR USING



Radiation Badges

- All badges are certified to ensure maximum accuracy of the dose report.
- Wear the badge flat against your body at your neck. [Unless you are pregnant and issued a waist badge also.]
- Do not wear badges on a chain, which would allow the badge to turn at various angles as you work.
- Turn in the badge for processing at the end of the monitoring period. The badges must be sent to the vendor for processing.



RADIATION

Remember to:

- Wear only your own badge
- Wear it whenever working at Tufts Univ.
- Leave it in a cool, dry place away from radiation when not in use
- Do not take your badge home.
- Do not launder the badge or get it wet.
- Do not expose to heat, such as in a car in summer.
- Do not open badge.
- Do not expose the badge to other sources of radiation.
- Do not wear the badge for personal x-ray or nuclear medicine exams.
- Turn in your badge for processing in a timely manner.
- Please cancel badge service when no longer needed.

IMAGES OF X RAY SAFETY SYSTEM

