KARNATAKA RADIOLOGY EDUCATION PROGRAM

FLUROSCOPY

Since Thomas A. Edison invented the fluoroscope in 1896, it has served as a valuable tool in the practice of radiology.

A radiologic technique in which a fluoroscope is used to visually examine the body or an organ. (A fluoroscope utilizes an X-ray tube and fluorescent screen, with the area to be viewed placed between the screen and the tube.) This immediate imaging, when coupled with an image intensifier, is invaluable in situations such as cardiac catheterization, thin needle biopsies of tumors, and localization of foreign bodies.

CONVENTIONAL FLUOROSCOPY

The kVp of operation depends entirely on the section of the body that is being examined. Fluoroscopic equipment allows the radiologist to select an image brightness level that is subsequently maintained automatically by varying the kVp, the mA, or sometimes both. This feature of the fluoroscope is called automatic brightness control (ABC).

kVp DEPENDS ON THE BODY PART BEING EXAMINED

mA VARIES WITH THE BODY PART

The principal advantage of image-intensified fluoroscopy over earlier types of fluoroscopy is increased image brightness. Just as it is much more difficult to read a book in dim illumination than in bright illumination, it is much harder to interpret a dim fluoroscopic image than a bright one.

IMAGE INTENSIFIER

The image-intensifier tube is a complex electronic device that receives the image-forming x-ray beam and converts it into a visible-light image of high intensity. The tube components are contained within a glass or metal envelope that provides structural support but more importantly maintains a vacuum. When installed, the tube is mounted inside a metal container to protect it from rough handling and breakage.

X-rays that exit the patient and are incident on the image-intensifier tube are transmitted through the glass envelope and interact with the input phosphor, which is cesium iodide (CsI). When an x-ray interacts with the input phosphor, its energy is converted into visible light; this is similar to the effect of radiographic intensifying screens.

The CsI crystals are grown as tiny needles and are tightly packed in a layer of approximately 300 μm Each crystal is approximately 5 μm in diameter. This results in microlight pipes with little dispersion and improved spatial resolution.

The next active element of the image-intensifier tube is the photocathode, which is bonded directly to the input phosphor with a thin, transparent adhesive layer. The photocathode is a thin metal layer usually composed of cesium and antimony compounds that respond to stimulation of input phosphor light by the emission of electrons.

The photocathode emits electrons when illuminated by the input phosphor.

This process is known as photoemission. The term is similar to thermionic emission, which refers to electron emission that follows heat stimulation. Photoemission is electron emission that follows light stimulation.

Multifield Image Intensification

Most image intensifiers are of the multifield type. Multifield image intensifiers provide considerably greater flexibility in all fluoroscopic examinations and are standard components in digital fluoroscopy

Two methods are used to electronically convert the visible image on the output phosphor of the image intensifier into an electronic signal:

Thermionic television camera tube

The solid state charge-coupled device (CCD).

The simplest method is to use a bundle of fiber optics

The simplest method is to use a bundle of fiber optics. The fiber optics bundle is only a few millimeters thick and contains thousands of glass fibers per square millimeter of cross section. One advantage of this type of coupling is its compact assembly, which makes it easy to move the image-intensifier tower. This coupling is rugged and can withstand relatively rough handling.

The video signal is amplified and is transmitted by cable to the television monitor, where it is transformed back into a visible image. Image Recording The conventional cassette-loaded spot film The photospot camera is similar to a movie camera except that it exposes only one frame when activated

During fluoroscopy, the cassette is parked in a lead-lined shroud so it is not unintentionally exposed. When a cassette spot-film exposure is desired, the radiologist must actuate a control that properly positions the cassette in the x-ray beam and changes the operation of the x-ray tube from low fluoroscopic mA to high radiographic mA. Sometimes, it takes the rotating anode a second or two to be energized to a higher speed.

The cassette-loaded spot film is masked by a series of lead diaphragms that allow several image formats. When the entire film is exposed at one time, it is called "one-on-one." When only half of the film is exposed at a time, two images result—"two-on-one." Four-on-one and six-on-one modes are also available, with the images becoming successively smaller.

The photospot camera does not require significant interruption of the fluoroscopic examination and avoids the additional heat load on the x-ray tube that is associated with cassette-loaded spot films. The photospot camera uses film sizes of 70 and 105 mm.

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