SNS COLLEGE OF ALLIED HEALTH SCIENCES- COIMBATORE 35

DEPARTMENT : RADIOGRAPHY AND IMAGNG TECHNOLOGY

SUBJECT : GENERAL PHYSICS, RADIATION PHYSICS AND PHYSICS OF DIAGNOSTIC RADIOLOGY

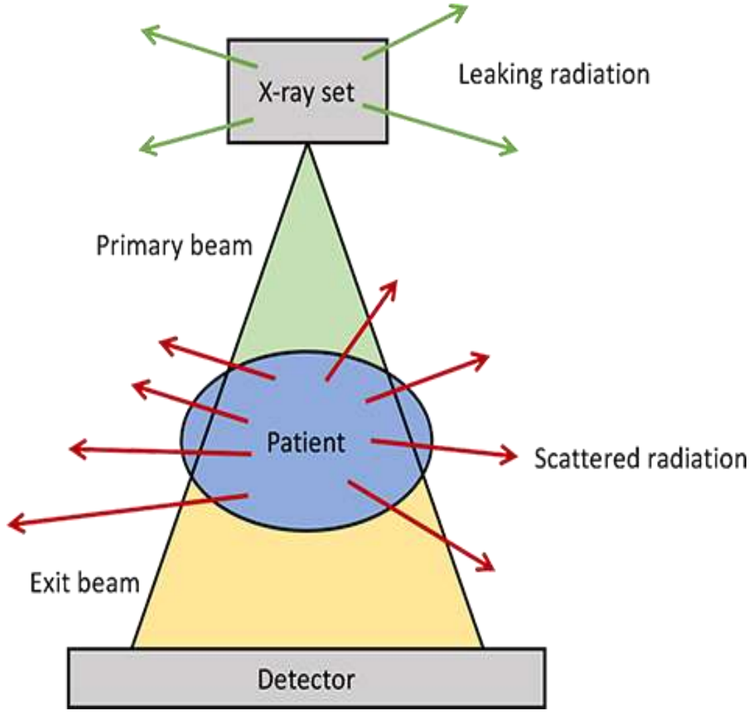
PAPER : PAPER II (UNIT 5 – PHYSICS OF DIAGNOSTIC RADIOLOGY : X-ray TUBE)

TOPIC : 6. SCATTER RADIATION

TYPES OF RADIATION

There are three types of radiation involved in patient imaging, namely,

- Primary,
- Scattered and
- Leakage radiation.
- Leakage radiation does not contribute to image formation and no discussion is required. However, primary and scattered radiations are responsible not only for image formation but also the degree of image quality.
- Scattered radiation mainly depends on kVp, field size and patient thickness.



SCATTER RADIATION DEPENDANCE

KVp increases

- As the kVp increases, the X-ray energy increases. As a result, Compton interaction increases, and photoelectric interaction decreases.
- Hence, increase of kVp, increases the scatter radiation and reduces. image quality. Therefore, X-ray imaging should be done with minimum KVp, with lowest scatter.

Field Size

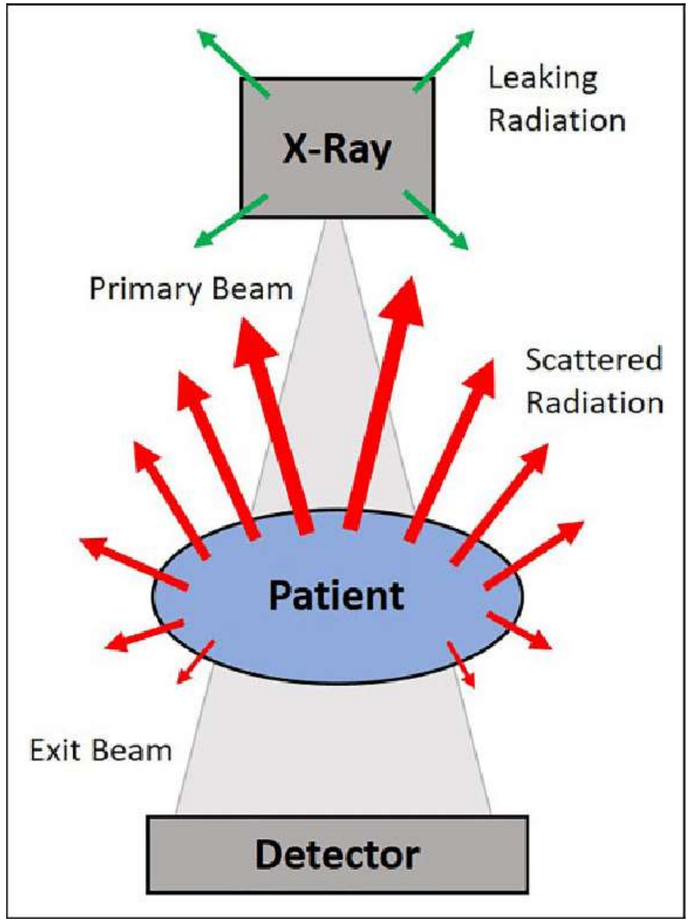
- Scattered radiation increases with field size. As the field size increases, scatter radiation also increases, which reduces the contrast of the image Smaller the field size, lesser the scatter radiation and lesser the optical density.

Patient Thickness

- Scatter radiation increases with patient thickness. More scatter radiation is involved with thicker patients or thicker body parts. Mainly muscle, fat, bone and fluid filled cavity (pathology) are the sources of scatter radiation.
- Abdomen X-ray produces 3 times higher scatter than that of extremity X-rays. Compression will reduce patient thickness and bring the patient closer to the film. It will improve spatial and contrast resolution, with reduced patient dose, Patient thickness cannot be controlled except in mammography, only proper selection of techniques will help to obtain a good quality image.

HOW IS SCATTER RADIATION PRODUCED ?

- Similar to a stream of water hitting a surface and splashing off in all directions, scatter radiation is produced when a radiation beam hits an object.
- While most of the radiation continues through the substance to create the x-ray, some of the rays come apart and bounce off the substance (whether that be tissue, bone, medical equipment, or even the walls of the room).
- When x-rays are performed, the object creating the most scatter radiation is the patient.
- As the primary radiation beam enters the patient, some of it scatters and ricochets (to fly away from a surface after hitting it.) around the room.
- The radiation that makes it through the body and onto the image receptor is called remnant radiation.



TYPES OF SCATTER RADIATION

There are several types, and each kind requires its own mitigation strategies and protective barriers in order to protect staff from the cumulative effects of radiation.

BACKSCATTER

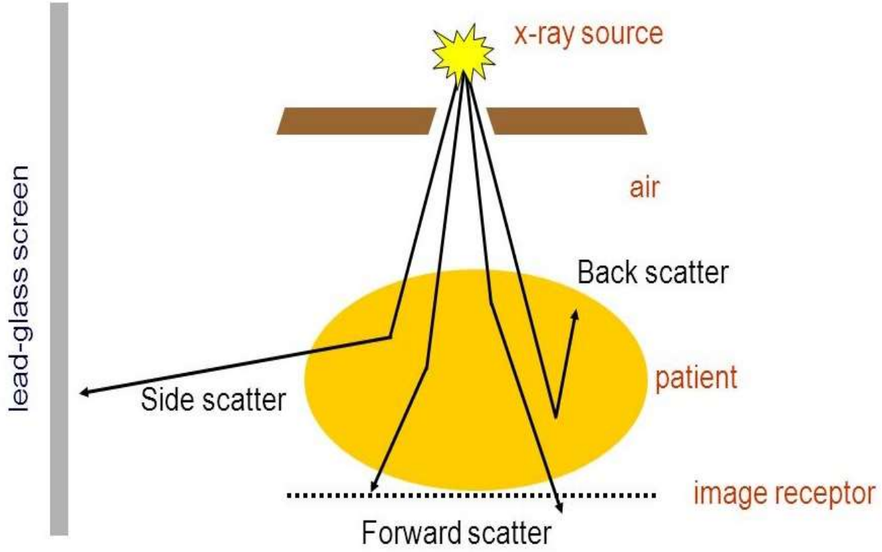
- This is created by remnant radiation that exits a patient's body and then bounces off the film, heading back towards the X- ray tube.

SIDE SCATTER

- This type of radiation is created by objects in the x-ray room. For example, chairs, tables, and even the floors and ceiling.

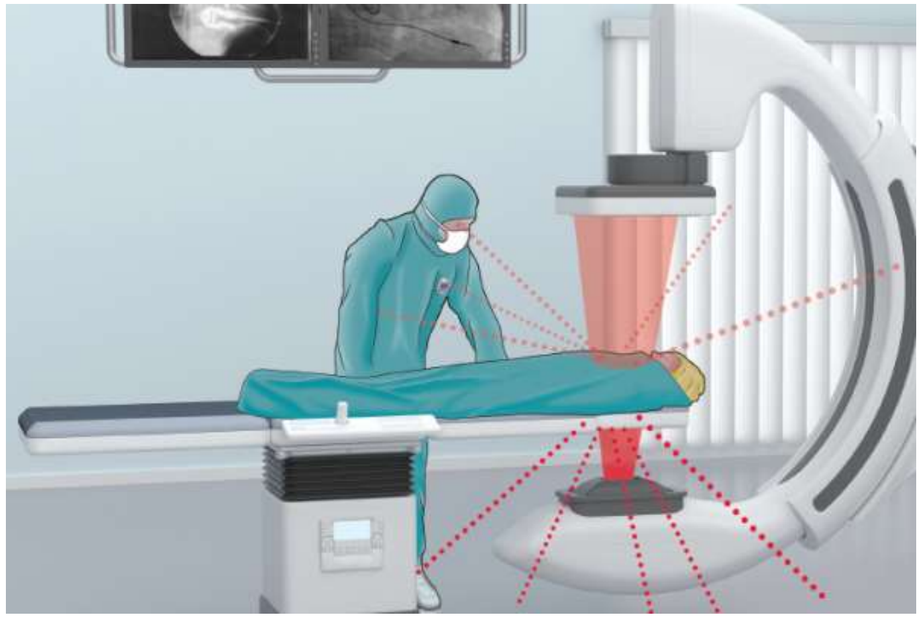
SCATTER RADIATION

- While both backscatter and side scatter can colloquially fall under this umbrella term, an exact definition requires X- rays bouncing off a patient's body



WHAT ARE THE SIDE EFFECTS OF SCATTER RADIATION ?

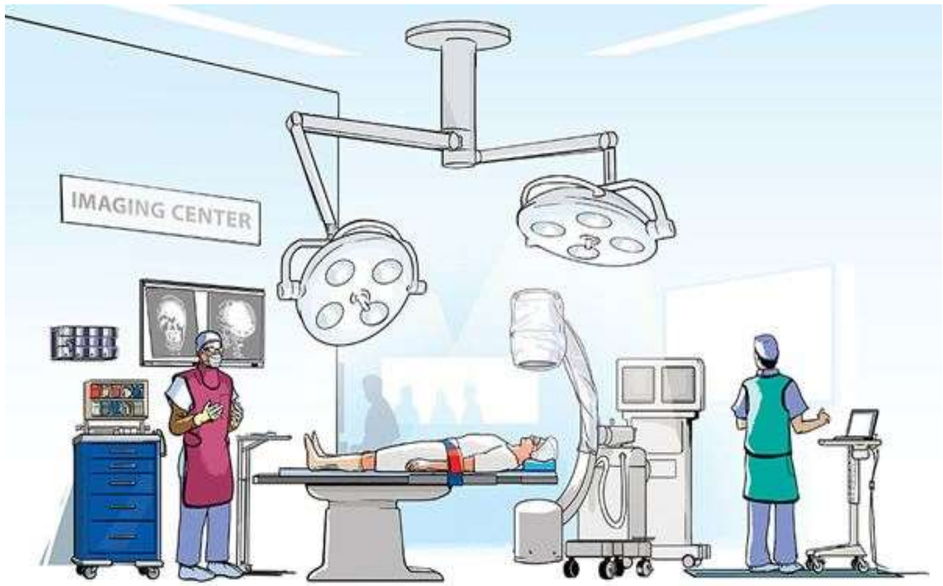
- X-ray radiation has the potential to damage cells, causing serious and sometimes fatal (causing or ending in death) conditions.
- The difference between x-ray photons coming from the x-ray machine and those generated as scattered radiation is that rays from the primary beam have full momentum, so they can cause more damage.
- On the other hand, scatter radiation is a ricochet and so has had some of its energy absorbed by whatever object it impacted.
- That said, while the most dangerous radiation comes from direct contact with the primary x-ray beam, scatter radiation can still cause severe damage to the body over time.



AFFECTS OF SCATTER RADIATION

How Does it Affect Patients?

- Because patients are typically exposed to only a few instances of the scatter, the truly at-risk parties are radiology technicians and others who frequently administer x-rays.
- The primary concern is limiting time spent under or in front of a primary radiation beam for patients.



How Does it Affect Technologists?

- When a radioactive x-ray photon bounces off an object and then hits a technologist or physician, the radiation can collide with atoms in the body, knocking electrons out of orbit and transforming atoms into ions or electrically charged atoms.
- Health problems can emerge if enough atoms are damaged, including cancer, cataracts, burns, hair loss, and many other painful and chronic conditions.

HOW TO PROTECT AGAINST SCATTERED RADIATION ?

- While the average person is only exposed to a couple of instances of scatter radiation per year, radiologists and technologists can be exposed to dozens of x-rays each day.
- And since radiation damage increases with each exposure, these healthcare professionals must take mitigating steps to protect against cancer and other conditions.

PROTECTIVE GARMENTS

Because the radiation can come from any direction, its important for technicians who are in the room with an x-ray machine to wear protective garments. Examples of protective gear include,

Protective X-ray Aprons.

- Many aprons provide protection for the front and back of the body, including the upper legs. These can be paired with full or half-length sleeves for enhanced radiation protection.

Leaded Eyewear.

- Radiation can damage atoms in the eye, resulting in cataracts and other conditions. Leaded glass eyewear protects the eye, blocking radiation.

Protective Gloves.

- Exposing the hands to radiation can cause burns, hair loss, and pain. Attenuating gloves stop radiation and keep the hands safe.

Thyroid Shield Covers.

- Radiation can cause thyroid cancer. By wearing a thyroid guard, technologists can block radiation and keep their neck and thyroid healthy.

PROTECTIVE BARRIERS

Sometimes, aprons aren't enough. When the level of radiation is especially high, barriers and shields are necessary in order to ensure radiation blocking. Examples of radiation shields include,

Mobile Radiation Shields

- The Terminator XRTM is an industry- leading portable x-ray shield that provides long bone protection and defends doctors and technicians from scattered radiation during long procedures.

Scatter Reducing Shields

- These flexible shields are placed on patients to protect them from excessive radiation. Many shields include holes to allow for medical procedures like dialysis, angiography, biopsies, and device implant procedures.

INTERROGATIONS

1. What is scatter radiation ?
2. Types of scatter radiation
3. How you minimize the scatter radiation ?

INTERROGATIONS

1. What is Attenuation ?
2. What is Absorption ?
3. What is Scattering ?

REFERENCES

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THANK YOU