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Subject :- Therapeutic Radiology

~~Sumitte~~ Submitted by : Mam. Aleeba

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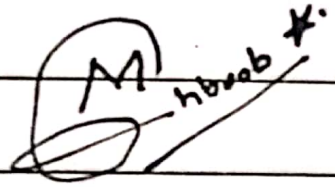
Dept :- Bs "Radiology" 6th semester



Q No:1

Ans ↳ Side effect of Therapeutic Radiology on the Human body..

Ans

Acute Side EFFECTS

1- Nausea and Vomiting :.
2- Damage to the ePithelial Surfaces.
3- Mouth, throad And Stomach Sore
4- Swelling.
5- InFertility.

Late Side effects.

1- Fibrosis.
2- EPiLation.
3- Dryness.
4- Lymphemema
5- Cancer
6- Heart Diseases.
7- Coginitive Decline.
8- Radion Rsotitis.
9- Cumulative side effect.

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10- Effects on Reproduction

11- Effects on Pituitary System.

Acute Side effects

(1) **Nausea & Vomiting:**

This is not a general side effect of radiation therapy, and mechanistically is associated only with treatment of the stomach or abdomen. (which is commonly exact a few hours after treatment).

As with any distressing treatment, Some Patient Vomit immediately during radiotherapy. Nausea for any reason can be treated with antiemetic

(2) **Damage to the epithelial surfaces:**

Epithelial surface may sustain damage from radiation therapy. Depending on the area being treated. this may ~~incl~~ include the skin, oral mucose

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Pharyngeal, bowel mucose ulceted Skin sections tend to be worse in area where there are natural folds in the skin as underneath the female breast, behind the ear and the groin.

3- Mouth, throat and Stomach sores:-

If the head and neck area is treated temporary soreness and ulceration commonly occur in the mouth and throat. If severe, this can affect swallowing, and the patient may need painkillers and nutritional support / food supplements.

3- Intestinal discomfort:-

The lower bowel may be treated directly with radiation (treatment of rectal or anal cancer) or be exposed by radiation therapy to other pelvic structures. Typical symptoms are soreness, diarrhoea, and nausea.

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(4) **Swelling:**

As Part of the General Inflammation that occuss swelling of soft tissues may Problems during radiation theraphy.

(5) **Infertility:**

The Gonads (ovaries and testicles) are very sensitive to radiation. They may be unable to Produce Gamates following direct exposure to most normal treatment doses of radiation.

Late Side Effects.

(1) **Fibrosis:**

Tissues which have been irradiated tend to become less elastic over time due to a diffuse scarring Process.

(2) **Epilation:**

Epilation (Hair Loss) may occur on any hair bearing skin with doses above 1Gy.

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(3) **Dryness:-**

The salivary glands and tears glands have a radiation tolerance about 30 Gy in Gy fraction, a dose which is exceeded by most medical head and neck cancer treatment.

(4) **Lymphedema:-**

Blockage of the lymphatic vessels leads to fluid retention. is Lymphedema, a condition of localized fluid retention and tissue swelling, can result from damage to the Lymphatic system sustained during radiation therapy.

(5) **Cancer:**

Radiation Induced Cancer.

Radiation is a Potential cause of cancer, and secondary malignancies are seen in a very small minority of Patients - usually less than 1/1000. The cancer occurs within the treated of the Patient.

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(6) **Heart disease:.**

↳ Radiation has Potentially excess risk of death from heart disease seen after some Past breast Cancer RT regimens.

(7) **Cognitive Decline:.**

↳ Radiation-induced brain injury.

↳ In cases of radiation applied to the head radiation may cause cognitive decline.

(8) **Radiation Proctitis:.**

↳ This can involve Long-term effects on the rectum including, diarrhoea and urgency and is associated with radiation therapy to Pelvic organs.

(9) **Cumulative Side effects.**

↳ Cumulative effects from this Process should not be confused with

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Long term effects. When short-term effect have disappeared and long-term effects are subclinical, reirradiation can still be problematic.

Effects on Pituitary System:-

↳ Hypopituitarism commonly develops after radiation therapy for Sellar and Parasellar neoplasms. extrasellar brain tumours head and neck tumours and following whole body irradiation for systemic malignancies. Changes in Prolactin-secretion is usually mild and vasopression deficiency appears to be very consequence of radiation.

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Q2

Ans

Linear accelerator :-

↳ High-energy radiation is delivered to tumors by means of a linear accelerator. A beam of electrons is generated and accelerated through a waveguide that increases their energy to the KeV to MeV range. These electrons strike a tungsten target and produce X-rays.

↳ X-rays generated in the 10-301 KeV range are known as grenz rays, whereas the energy range for superficial unit is about 30-125 KeV. Orthovoltage units generate x-ray from 125 - 500 KeV.

How Machine works :-

What is this equipment used for:-

↳ A medical linear accelerator (LINAC) is

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the device most commonly used for the external beam radiation treatment for Patients with Cancer. It delivers high energy x-ray or electron to the region of the Patient's tumor.

↳ The LINAC is used to treat all body sities. Using Conventional techniques- intensity - modulated Radiation Therapy (IMRT) Volumetric Modulated Arc Therapy (VMAT) Image Guided Radiation therapy (IGRT) Stereotactic Body Radio therapy (SBRT).

How Machine Work:.

↳ The linear accelerator uses microwave technology (similar to that used for radar) to accelerate electrons in a Part of the accelerator called the wave guide. then allows these electrons to collide with a heavy metal target to Produce high-energy x-rays.

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↳ These high energy x-rays are shape as they exit the machine to conform to the shape as they Patient's tumor and the customized beam is directed to the Patient tumor. The beam is usually shaped by a multileaf collimator that is incorporated into the head of the machine. The Patient lies on a movable treatment couch and lasers are used to make sure the Patient is in the Proper Position.

↳ The treatment Couch can move in many directions including up-down, right, left in and out.

↳ Radiation can be delivered to the tumor From many angles by rotating the gantry and moving the treatmen couch.

Who operates this equipment?

↳ The Patient's radiation oncologist - Prescribes the appropriate

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treatment volume and dosage. The medical Physicist and dosimetrist determine how to delives the Prescribed ~~does~~ ~~dose~~ dose and Calculate the amount of time it will take the accelerator to delives that dose.

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Q3

Ans

Interaction of Matter Photoelectric effect and Comptom effects

Photoelectric Effect.

↳ X-ray is the diagnostic range also undergo ionizing interaction with inner shell electron. The x-ray is not scattered, but it totally absorbed. This Process is called the Photoelectric effect.

↳ The electron removed from the atom is a Photoelectron and escape with kinetic energy equal to the difference between the energy of the incident x-ray and the binding energy of the electron. mathematically this.

$$E_i = E_o + E_n$$

↳ The Photoelectric effect is totally x-ray absorption.

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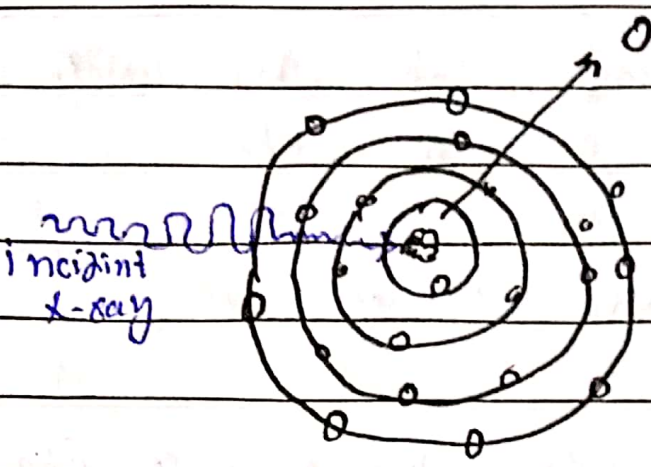

$E_i = E_o + E_n$

↳ whose E_i is the energy of the incident x-ray, E_o is the electron binding energy, and E_n is the kinetic energy of the electron.

Compton Scattering:

↳ X-ray throughout the diagnostic range can undergo an interaction with outer shell electron. that not only scatters the x-ray but reduces it energy and ionizes the atom as well. This interaction is called Compton scattering.

↳ The x-ray continues in a different direction with less energy.

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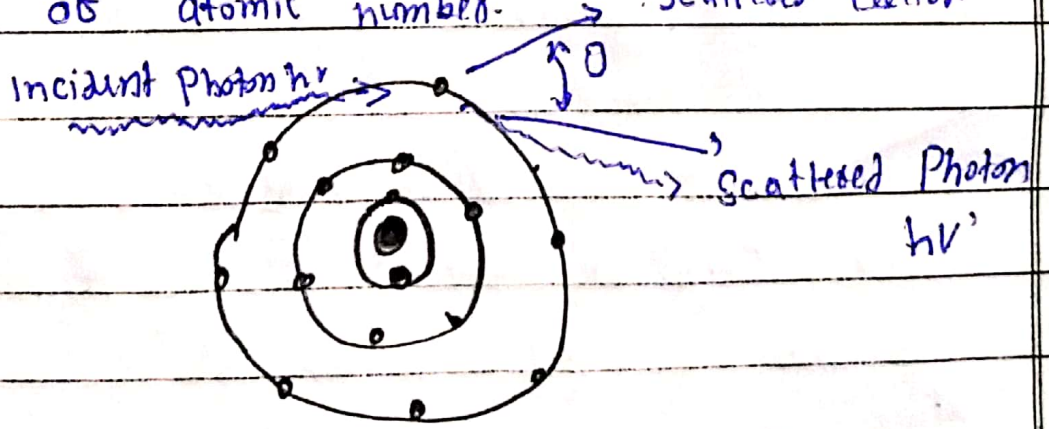
4- The energy of the compton - scattered x-ray is equal to the difference between the energy of the incident x-ray and the energy of the ejected electron. The energy pulse of the ejected electrons is equal to its binding energy.

Compton Effect.

$$E_1 = E_3 (E_b + E_{KE})$$

Where E_1 is energy of the incident x-ray, E_s is energy of the scattered x-ray, E_b is electron binding energy, and E_{KE} energy of the electron.

5- The Probability of compton Scattering is inverse Proportional to x-ray energy ($1/E$) and independent of atomic number.



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Q.4

Ans

Brachytherapy:

↳ Brachytherapy (brak-e-THER-uh-pee) is a ~~Procedure~~ Procedure that involves Placing radioactive material inside your body. Brachytherapy is one type of radiation therapy that's used to treat cancer. Brachytherapy is ~~sometimes~~ sometime Called ~~internal~~ internal radiation."

↳ Brachytherapy (internal radiation therapy) is delivered by placing radiation source(s) inside or next to the area requiring treatment.

↳ Brachytherapy is commonly used as an effective treatment for cervical, Prostate, breast, and skin cancer and can also be used treat tumors in many other body sites.

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↳ As with stereotatic radiation, Brachytherapy treatment are often known by their brand names.

↳ For example. brand name for breast cancer brachytherapy treament include SAVI, Mammosite and Contura.

↳ Characteristics of Brachytherapy Provide Advantages over external beem radiation therapy. ↳ The tumor can be treated with very high Cases of Localized radiation, whilst reducing the Probability of unnecessary damage to surrounding healthy tissue.

→ As one example of the Localized nature of breast brachytherapy, the SAVI device delivers the radiation dose through multiple ~~catheters~~ Catheters each of which can be individually Controlled.

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Q5 Ans

Volumetric modulated arc therapy (VMAT)

↳ Volumetric modulated arc therapy (VMAT) is a new radiation technique which can achieve highly conformal dose distribution on target volume coverage and sparing of normal tissue.

↳ The specificity of this technique is to modify the three parameters during the treatment.

↳ VMAT also has the potential to give additional advantages in patient treatment, such as reduced delivery time of radiation, compared with conventional static field intensity modulated radiotherapy (IMRT).

(1) **Particle therapy:-**

↳ Particle therapy is a form of external beam radiotherapy using beam of energetic neutrons.

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Protons, or other heavier positive ions for cancer treatment - The most common type of particle therapy as of 2012 is Proton therapy.

Advantages

↳ The advantage of this energy deposition profile is that less energy is deposited into the healthy tissue surrounding the target tissue.

(ii) Auger therapy:-

↳ Auger therapy is a form of radiation therapy for the treatment of cancer which relies on a large number of low energy electrons (emitted by the Auger effect) to damage cancer cell, rather than the high-energy radiation used in traditional radiation therapy.

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Auger therapy (AT) makes use of very high dose of ionizing radiation in situ that provides molecular modification at an atomic scale.

THE End