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Q 4 Write Note on brachytherapy?

Answer:-

Brachytherapy:-

→ Brachy therapy (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 to treat tumors in many other body sites.

→ For example, brand names for breast Cancer brachytherapy treatments include SAVI, Mammosite, and Contura.

→ Brand name for prostate cancer include Proxcelan, TheraSeed, and I-Seed.

→ In Brachytherapy, radiation sources are precisely placed directly at the side of the cancer tumor.

→ This means that the irradiation is only affects a much localized area - exposure to radiation of healthy tissues further away from the sources is reduced.

→ These characteristics of Brachytherapy provide advantages over external beam radiation therapy - the tumor can be treated with very high doses of localized radiation, whilst reducing the probability of

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unnecessary damage to surrounding healthy tissues.

→ A course of Brachytherapy can often be completed in less time than other radiation therapy techniques. This can help reduce the chance of surviving cancer cells dividing and growing in the intervals between each radiation therapy dose.

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

→ Brachytherapy is the term used to describe radiation treatment in which the radiation source is in contact with the tumor. This therapy contrasts with external beam therapy in which the radiation source is 80–100 cm away from the patient.

In brachytherapy, dose ~~radiation~~ distribution is almost totally dependent on the inverse square law because the source is usually within the tumor volume. Because of this inverse square law dependence, proper placement of radiation sources is crucial.

Q 5- Explain how volumetric modulated arc therapy works for the Cancer body?

Answer

Volumetric Modulated arc therapy:-

→ Volumetric modulated arc therapy (VMAT) is a new radiation technique, which can achieve highly conformed dose distributions on target volume coverage and sparing of normal tissue.

→ The ~~Specific~~ specificity of this technique is to modify the three parameters during the treatment. VMAT delivers radiation by rotating gantry (usually 360°) rotating fields with one or more arc(s) changing speed and shape of the beam with a multileaf collimator (MLC) ("so sliding window" system of moving) and fluence output rate (dose rate) of the medical linear accelerator.

→ 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)

(i) Particle Therapy:-

In particle therapy (proton therapy being one example), energetic ionizing particles (protons or carbon ions) are directed at the target tumor. The dose increases while the particle penetrates the tissue up to a maximum (the Bragg peak) that occurs near the end of the particle's range, and it then drops to (almost) zero. 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 (AT) makes use of a very high dose of ionizing radiation in situ that provides molecular modifications at an atomic scale.

→ AT effects differs from conventional radiation therapy in several aspects. it neither relies upon radioactive nuclei to cause cellular radiation damage at a cellular dimension, nor engages multiple external pencil-beams from different directions to zero in to deliver a dose to the targeted area with reduced dose outside the targeted tissue.

→ Instead, the in situ delivery of a very high dose at the molecular level using AT aims for in situ molecular no diffraction ~~level using~~ involving molecular breakages and molecular re-arrangements such as a change of stacking structures, as well as cellular metabolic functions related to the said molecule structures.

Q 3. write the interaction of matter photoelectric effect and compton effects.

Answer

Photon tissue Interaction:.

Three interactions describe photon ~~abso~~ absorption in - tissues.

(i) Photoelectric effect.
(ii) Compton effect
(iii) Pair production.

photo electric effect:

In this process, an incoming photon undergoes a collision with a tightly bound electron. The photon transfers practically all of its energy to the electron and ceases to exist. The electron departs with most of the energy to the

from the photon and begins to ionize surrounding molecules. This interaction depends on the energy of the incoming photon, as well as the atomic number of the tissue; the lower the energy and the higher the atomic number, the more likely that a photoelectric effect will take place.

An example of this interaction in practice can be seen on a diagnostic x-ray film. Since that atomic number of bone is 60% higher than that of soft tissue, bone is seen with much more contrast and detail than is soft tissue. The energy range in which the photoelectric effect predominators in tissue is about 10-25 keV

Compton effects:

The Compton effect is the most important photon-tissue interaction for the treatment of Cancer. In this case, a photon collides with a "free electron" i.e one that is not tightly bound to the atom. UNlike the photoelectric effect, in the Compton interaction both the photon and electron are scattered. The photon can then continue to undergo additional interactions, albeit with

a lower energy. The electron begins to ionize with the energy given to it by the photon.

The probability of a compton interaction is inversely proportional to the energy of the incoming photon and is independent of the atomic number of the material. When one takes an image tissue using photons in the energy range in with the compton effect dominates (≈25 keV - 25 MeV), bone, soft tissue ~~interfact~~ interfaces are hardly distinguishable. This is result of the atomic number independence.

Q 2) What do you know about linear accelerator, how the machine work.

Answer::

Linear accelerator:-

A medical linear accelerator (LINAC) customizes high energy x-rays or electrons to conform to a tumor is shape and destroy cancer cells while sparing surrounding normal tissue. It features several built-in saftey measures to ensure that it will deliver the dose as prescribed and is routinely checked by a medical physicist to ensure it is working properly

If you are scheduled for radiation oncologist will collaborate with a radiation dosimetrist and a medical physicist to develop a treatment plan for you. They will double check this plan before treatment begins and implement quality assurance procedures to ensure that each treatment is delivered in the exact same manner.

How does the machine work:?

The linear accelerator uses microwave technology 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. These high energy x-rays are shaped as they exit the machine to conform to the shape of the patient's tumor and the customized beam is directed to the patient's tumor and the customized beam is directed to the patient's 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 couch can move in many directions including up, down, right, left in and out. The beam comes

out of a part of the accelerator called a gantry, which can be rotated around the patient. Radiation can be delivered to the tumor from many angles by rotating the gantry and moving the treatment couch.

Machine Used For:

It is a device ~~used for~~ most commonly used for external beam radiation treatment for patients with cancer. It delivers high energy x-rays or electrons to the region of the patient tumor. These treatments can be designed in such a way that they destroy the cancer cells while sparing the surrounding normal tissue. The LINAC is used to treat all body sites, using conventional techniques, ~~latest~~ Intensity modulated Radiation therapy, VMAT, IGRT, SRS, SBRT.

Operating of the (LINAC)

The patients radiation oncologist prescribes the appropriate treatment volume and dosage. The medical physicist and the dosimetrist determine how to deliver the prescribed dose and calculates the

the amount of time it will take the accelerator to deliver the dose. Radiation therapist operate the linear accelerator and give patients their daily radiation treatments.

Q 1 What are the side effects of therapeutic radiology on the human body?

Answer

Side Effect of therapeutic Radiology:.

ACUTE Side Effects:

-> Nausea, vomiting
-> Damage To The Epithelial surfaces
-> Mouth, Throat and stomach Sores.
-> Intestinal discomfort.
-> Swelling.
-> Infertility.

LATE Side Effects:.

-> Fibrosis
-> Epilation
-> Dryness
-> Lymphedema
-> Cancer
-> Heart disease.

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→ Congnitive Decline
→ Radiation protitis
→ Cumalative side effects
→ Effect on Reproductions
→ Effect on pituitary System.

ACUTE Side effects:

Nausea & Vomiting:

This is not a general side effect of radiation therapy. and mechanistically is associated only with treatment of the stomach or abdomen or with radiation therapy to certain causing producing structures in the head during treatment of certain head and neck tumors most commonly the vestibules of the inner ears. Some patent vomit immediately during radiotherapy. Nausea for any reason can be treated with antiemetics.

Damage to the epithelial surfaces:

Epithelial surface may sustain damage from radiation therapy. Depending on the area being treated this may include the skin, oral mucosa, pharyngeal, bowel mucosa and ureter. The rates of onset of damage and recovery from it depend upon the turnover rate of

epithelial cell. The reaction may become more severe during the treatment. Such as underneath the female breast, behind the ear and in the groin.

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 effect swallowing and the patient may need painkillers and nutritional support/food supplements. The esophagus can also become sore if it is treated directly, it receives a dose of collateral radiation during treatment of lung cancer. When treating liver malignancies and metastasis, it is possible for collateral radiation to cause gastric, stomach or duodenal ulcers.

Intestinal discomfort:-

The lower bowel may be treated directly with radiation or be exposed by radiation therapy to other pelvic structures. Typical symptoms are soreness, diarrhoea and nausea.

Infertility:

The gonads (ovaries and Testies are very sensitive to radiation). They may be unable to produce gametes following direct exposure to most normal treatment dose of radiation. Treatment planning for all body sites is designed to minimize if not completely exclude dose to the gonads. If they are not the primary area of treatment. Infertility can be efficiently avoided by sparing at least one gonad from radiation.

LATE Side effect:-

Fibrosis:

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

Epilation:

Epilation (hair loss) may occur on any hair bearing skin with doses above 1Gy. It only occurs within the radiation fields. Hair loss may be permanent with a single dose of 10Gy, but if the dose is fractionated permanent hair loss may not occur

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until dose exceed 45 Gy.

Dryness:

The salivary glands and tear glands have radiation, tolerance of about 30 Gy in Gy fractions, a dose which is exceed by most radical head and neck cancer treatements. Dry mouth and dry eyes can become irritating long-term problems and severely reduce the patient's quality of life. Similarly, sweat glands in treated skin tend to stop working and the naturally moist vaginal mucosa is often dry following pelvic irradiation.

Lymphoedema:

Lymphedema, a condition of localized fluid retention and tissue swelling, can result from damage to the lymphatic system sustained during radiation therapy. It is most commonly reported complication in breast radiation therapy patients. who receive adjuvant axillary radiotherapy following surgery to clear the axillary lymph nodes

Heart disease:

Radiation has potentially excess risk of death from heart disease seen after some past breast cancer RT regimens:

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The End