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http://publisher.uthm.edu.my/ojs/index.php/emait
e-ISSN : 2773-5540

Emerging Advances in Integrated Technology

Treatment Planning System in Radiotherapy: A Short Review

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DOI: https://doi.org/10.30880/emait.2023.04.02.007
Received 1 August 2023; Accepted 1 November 2023; Available online 31 December 2023

Abstract: Treatment planning is the core in radiotherapy. The present study aimed to explore the relationship between treatment planning system and radiotherapy. Some of the important steps in radiation treatment planning system have been discussed in this paper such as patient positioning, contouring, and simulation of pre-treatment. Detailed information has been acquired by the author associated with dose calculations in different conditions, techniques used in beam modification. Since ionising radiation creates ions in the cells of the tissues where it travels through, hence it has the capability to treat cancer cells. By taking away electrons from atoms and molecules, ions are created. It can therefore either eliminate the genes or inhibit their growth. The molecular processes leading to tissue damage illustrate that ionizing radiation not only globally affects biomolecules but also selectively alters various biomolecules in response to chemotherapy. Linear accelerator is abbreviated as LINAC. It produces high energy electron or X-ray beams using electricity. Although there are many applications for these beams, cancer treatment is one of them.

Keywords: radiotherapy, radiation dose, LINAC, collimator

1. Introduction

Radiotherapy is widely used to cure cancerous tumors nowadays. Nevertheless, the complexity of modern technologies raises the risk of inaccuracy. The radiation oncologist must precisely define the target area and contour it; the medical physicist must create the best plan for delivering the necessary dose while sparing normal tissue; and the technologist must ensure that the patient is positioned correctly once treatment is started. Treatment planning system has been an important concept in the study of radiotherapy. All radiation has some risk since a slight mistake is made in dosimetry, delivery, or treatment planning might come to have detrimental effects. This is because the human body is a complicated system and tumors are frequently situated near delicate healthy cells and important organs [1]. To ensure that a prescription is carried out as effectively as possible, treatment planning is required. Recent investigations show that radiotherapy is used as the main method of treatment for cancer for almost 50% of patients. The core of the radiation therapy process is the treatment planning system. In the context of radiotherapy, end-to-end testing refers to a quality-control process that begins with contour delineation and dosage prescription, continues with dose calculation and parameter transfer to the treatment unit, and concludes with dose delivery on the apparatus [2]. Radiotherapy treatment planning's goal is to identify a course of action that delivers sufficient tumor volume irradiation while maintaining the highest anticipated therapeutic proportion [3]. The main purpose of this study is to develop an understanding of treatment planning systems in the context of radiotherapy. However, the treatment planning system has rarely been studied detailly by researchers.

The fundamental components of the human body consist of cells. When the body necessitates new cells, existing ones undergo growth and division to generate them. Typically, cells undergo death due to aging or damage, and new cells take their place. Disruptions in this orderly process, often caused by genetic alterations, lead to the development of cancer. Uncontrolled cell proliferation initiates, resulting in the formation of a mass of cells known as a tumor. Tumors may be categorized as benign or malignant. Malignancy refers to the capability of a cancerous tumor to grow and

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spread to different regions of the body. In the case of a benign tumor, it may enlarge but does not exhibit the capacity to spread. Some cancers, such as leukemias, most lymphoma subtypes, and myeloma, do not give rise to a distinct tumor.

Cancer cells may disseminate to different body regions through the circulatory or lymphatic system as a malignant tumor spreads. During this process, the cancer cells undergo multiplication and may give rise to new tumors, a phenomenon known as metastasis. The lymph nodes often serve as initial sites for the spread of malignancy. Lymph nodes, small bean-shaped organs integral to the body's defense against infection, are found in various regions such as the neck, groin, and the undersides of the arms. Cancer has the potential to travel to distant areas of the body through the bloodstream, reaching organs like the brain, liver, lungs, or bones. Despite its spread, the malignancy retains the name of its original location; for example, breast cancer that metastasizes to the lungs is termed metastatic breast cancer rather than lung cancer.

A diagnosis frequently starts when a patient contacts a doctor with an uncommon symptom. The patient will discuss their medical history and current symptoms with the doctor. The doctor will then do several tests to determine what is causing these symptoms. A screening test can occasionally reveal cancer in a healthy individual. A Pap test, mammography, and colonoscopy are a few examples of screening tests. To support or refute the findings of the screening test, a person may require additional testing. Only a biopsy can provide a conclusive diagnosis for most malignancies. In a biopsy, a small sample of tissue is taken for additional research.

1.1 Radiation Therapy Principles

Understanding the typical course of a cell's life is useful before comprehending how radiation therapy functions. There are five phases in a complete cell cycle [4].

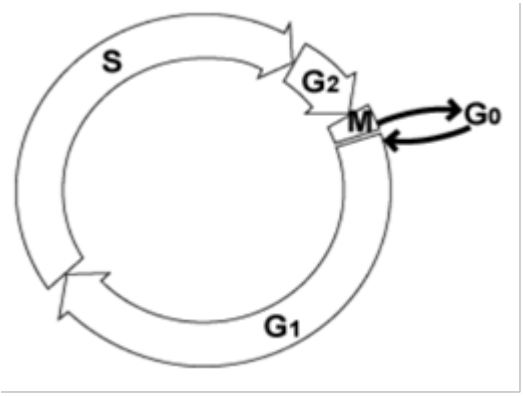

Fig. 1 - The cell cycle [4]

G_0 stage is known as resting stage. The process of cell division has not yet begun. A cell must accomplish several crucial processes before it can divide. It must expand, replicate its DNA, and physically separate into two daughter cells [5]. Therefore, during G_1 phase, the cell increases protein production as it prepares to divide [4]. The cell creates a full copy of the genetic material, DNA in its nucleus during the S phase [5]. The cell enters the G_2 stage after the DNA has been replicated and a whole additional set of all the genetic material has been synthesized. During this stage, the cell organises and begins to condense the genetic material in preparation for cell division. Moving forwards to the M phase, which is known as mitotic phase, this is the moment point that the cell divides the two copies of the genetic material amongst the two daughter cells [6].

The cell cycle phase is essential for cancer treatment since radiation often destroys cancer cells initially that are actively or rapidly growing. Cells that are replicating slowly or are currently in the resting phase (G_0) do not respond as quickly to it [4]. In several stages of the cell cycle, radio resistance differs also. In the G_0, early G_1, and late S phases of the cell cycle, cells are most resistant to radiation. However, in the late G_1, G_2, and M stages of the cell cycle, cells are most sensitive to radiation [7].

1.2 Radiation Treatment Planning System

Choosing which areas of the patient should receive radiation treatment and which areas should be avoided is the first stage in the treatment planning procedure. Based on the kind of tumor, the intended course of therapy, the availability of the appropriate equipment, and simulation can be done on a normal simulator such as CT simulator, or MR simulator. While the patient remains on the couch for a brief amount of time, beam directions and apertures are established through conventional simulation.

There are three basic parts to moderate treatment planning systems which are beam modelling, dose calculation engine and optimization engine. The beam model is a digital illustration of a beam that considers the energy distribution and beam modifications like MLC, flattening filters, and wedges. The application of the beam model to a specific patient and precise dosage computation are the responsibilities of the dose calculation engine. The best configuration of fields and field modifiers is determined by the optimization engine to create the treatment strategy [8].

1.3 Immobilizing and Positioning the Patient

Patient positioning is the most important parts in the radiotherapy treatment planning systems. One of the initial technical procedures in administering radiation therapy is immobilization [9]. Accurate and repeatable patient positioning is required so that the recommended dose accurately to the target can be delivered and spare healthy tissues over the several fractions that a course of radiation includes. In the case that it is also possible for a patient who is not immobilised while lying on the treatment table during the treatment process [10]. This will have a big impact on the dose received by the patient. Uncomfortable posture is one of the causes of patient movement while receiving therapy. Another frequently cited cause of these movements is prolonged treatment time. The tumour may also migrate from the desired treatment position due to involuntary movements like breathing and coughing [10]. To overcome this problem, different immobilisation equipment is used to restrict patient movement while undergoing therapy such as Knee and Foot Locks, Breast Boards, shoulder retractor, wing boards, mask and headrests, molds and Vac-Lok Bags [11]. The majority of the contemporary immobilisation devices have indexing features, which provide a way to lock the device into the treatment support table at the same location every day. Therefore, indexing offers a crucial double-check safety feature to avoid treating the patient in the incorrect spot [11]. Some other modern technologies used in immobilizing the patient are portal images, cone beam CT, radio-opaque markers, lasers, infrared tracking cameras [9].

2. Simulation of Pre- Treatment

Pre-treatment is the procedure used to gather pertinent data regarding the size, shape, and location of the part of the body being treated. The most popular method for doing this is a CT scan, which produces three - dimensional images of the patient that are utilised to construct personalized radiotherapy plans that enable the creation of a treatment prescription [12].

2.1 Computed Tomography Simulator (CT Scan)

Using X-rays, computed tomography creates high resolution images of parts inside the body. It is important that the radiation beam must be directed at the desired treatment site while avoiding as much healthy tissue as feasible when doing the radiotherapy planning. Therefore, this CT scan will enable us to accomplish that. The generated 3D images could offer additional details when arranging for treatment [13].

Fig. 2 - A photography of Computed Tomography simulator [14]

Compared to a typical diagnostic CT scan, a radiation planning CT scan differs slightly. It enables radiologists to get 3D images of the treatment site in order to develop personalized radiation treatments planning [14]. CT images offer good tissue contrast in three dimensions, enabling more accurate tumour detection and contouring. Moveable lasers are also provided in the CT room for setup purposes, such as marking the patient [9]. Tiny markings will need to be made on your skin with a felt-tipped pen during this procedure.

2.2 Positron Emission Tomography (PET)

Positron emission tomography (PET), which is utilised as an additional imaging technique for the purpose of

target delineation. With the technique of the combination of PET-CT for the same patient setup, both the CT and PET pictures can be obtained concurrently [9].

2.3 Magnetic Resonance Imaging (MRI)

Magnetic resonance imaging (MRI) is a form of radiation imaging device which creates precise images of the inside of the body by combining radio waves and powerful magnetic field [15]. Water molecules, which are composed of hydrogen and oxygen atoms, make up the majority of the human body. Each hydrogen atom consists of protons in its nucleus. Due to the facts that proton has charge, therefore it is sensitive to the magnetic fields. The protons in patients' bodies align in the same direction while they lie beneath the strong scanner magnets. Short bursts of radio waves are then directed at specific parts of the body, causing the protons to become misaligned. Then, the protons realign once the radio waves have been switched off. This emits radio signals that are detected by receivers. These signals reveal the precise position of the protons in the body. They also aid in identifying the different types of tissue in the body because their protons rearrange at varying rates and generate diverse signals. Similarly, to how millions of pixels on a computer screen may provide complex images, signals from millions of protons in the body are combined to produce a clear image of the internal structure of the body [15]. MRI checks don't include radiation like x-rays and computed tomography (CT) scans do [16].

2.4 Contouring

The most significant consideration in the treatment approach is contouring. There are various tools available to get patient contours. One of the techniques is a solder wire or a lead wire embedded in plastic, which is the most typical and straightforward method. Another type of basic tool is known as Mobile Contour Plotter (Figure 3) that contained a grid of rods, the tips of which are used to contact the patient's skin and are subsequently placed on a piece of paper to sketch contours [17]. The mechanical system in the contour plotter connects a drawing pen to a stylus arm. It transfers the patient’s body contours onto an overhead drawing board as it encounters the patient’s body [18].

Fig. 3 - Mobile contour plotter [17]

2.5 Depth Dose Profile

Calculation about the desired dose amount that required for patients is also an important concept in radiotherapy planning system. The absorbed dose from an incoming radiation beam changes with depth in the body of a patient (phantom). The variability can be characterised as percent depth dose (PDD), tissue-air ratio (TAR), tissue-phantom ratio (TPR), or tissue-maximum ratio (TMR) typically based on how the measurement setup [9].

2.5.1 Percent Depth Dose

A percentage depth dose curve can be plotted by measuring the dose that tissues absorb as a result of these radiation interactions. When the energy is increasing, the capacity of the beam to penetrate objects rises [19]. Percent depth dose refers to the proportion of the absorbed dose at a specific depth to the absorbed dose at a predetermined reference depth in the context of radiation therapy [20].

$$P_{dd}\,(d, r, SSD) = (D_d / D_m) \times 100 \quad (1)$$

where D_d refers to the reference depth, D_m refers to the maximum dose, and r refers to the field size while SSD refers to the source-skin distance.

2.5.2 Tissue-Air Ratio (TAR)

Based on the equation 2 below, "tissue air ratio" (TAR) refer as the proportion of the dosage absorbed at a

certain depth in tissue to the dose absorbed at the same position in air. TAR is affected by several variabilities such as beam energy, field size and depth. However, it will not be affected by source to surface distance [21].

$$TAR = \text{Dose in tissue}/ \text{Dose in air} \quad (2)$$

2.5.3 Tissue-Phantom Ratio (TPR)

The dosage at a specific position in phantom divided by the dose at the same point at a constant reference depth (typically 5 cm) is known as the TPR [21].

$$TPR = D_d/ D_{dr} \quad (3)$$

where D_d refers to the dose in tissue and D_{dr} refers to the dose at the same distance in the phantom at a reference depth.

2.5.4 Tissue-Maximum Ratio (TMR)

The Tissue Maximum Ratio (TMR) is defined as the proportion of the dose at a specific point and depth in phantom to the dose at a similar point at the depth of the maximum dose in phantom [22].

$$TMR = D_d /D_{dmax} \quad (4)$$

where D_d refers to the dose in tissue and D_{dmax} refers to the maximum dose. TMR is affected by some variabilities, for example, energy and field size. It is self-sufficient on SSD at low megavoltage energies but relies on SSD at high megavoltage energies [23].

2.5.5 Backscatter Factor (BSF)

The backscatter factor refers to the proportion of the maximal dosage to the dose in air at the same depth in the phantom [23].

$$BSF = D_{max}/ D_{air} \quad (5)$$

2.5.6 Collimator Scattering Factor (S_c)

The collimator scatter factor refers to the proportion of a particular field's dosage in air to that of a reference field [10].

2.5.7 Phantom Scattering Factor (S_p)

The phantom scatter factor (S_p) refers to the proportion of the dosage or dose rate for a particular field at a reference depth to the equivalent depth for the reference field size with constant collimator scatter [10]. The total scattering factor is the production of collimator scattering factor and the phantom scattering factor.

2.5.8 Monitor Unit Calculations

Monitor Unit (MU) is defined as a unit of measurement for radiation "beam-on" time in medical linear particle accelerators (LINAC). Under precise calibrated circumstances for the medical LINAC, one monitor unit equals 1 cGy of radiation absorbed in water [24].

2.5.9 Non-Isocentric Technique

For the non-isocentric technique, equations (6) to (8) are applied.

$$MU = (TD \times 100)/ [K \times (DD\%)d \times Sc\ (rc) \times Sp\ (r) \times SSD\ factor] \quad (6)$$

$$Rc = r\ (SAD/SSD) \quad (7)$$

$$SSD\ factor = (SCD/ SSD + t0)^2 \quad (8)$$

where TD refers to the fraction dose, K is equals to 1cGy/MU, t_0 refers to the reference depth, S_c refers to the collimator scattering factor, S_p refers to the phantom scattering factor, DD% refers to the percentage depth dose, r refers to the collimator field size, SCD refers to the source to collimator distance and SSD refers to the source to skin distance.

2.5.10 Isocentric Technique

For the isocentric technique, equations (9) to (10) are applied.

$$MMU = (1D/ K) \times [TMR (d, rd) \times Sc (rc) \times Sp (rd) \times SAD\ factor] \quad (9)$$

$$SSD\ factor = (SCD / SAD)^2 \quad (10)$$

where ID refers to the fraction dose, K equals to 1cGy/MU, t_0 is reference depth, S_c is collimator scattering factor, S_p refers to the phantom scattering factor, TMR refers to the tissue maximum ratio, r refers to the collimator field size, SCD refers to the source to collimator distance and SSD refers to the distance of skin to the source. Noted that when using a tray or wedge in the radiation therapy, a tray factor (TF) or wedge factor (WF) has to be applied to the denominator as multiplier [23].

2.5.11 Beam Modifiers

There are many types of beam modifiers can be choose to use in radiation treatment planning system such as field blocking and shaping devices, compensators, beam spoilers, wedge filters, beam flattening filters, bolus, breast cone, penumbra trimmers and electron beam modifications.

2.5.12 Wedge Filters

Prior to reaching the target, it is essential to filter the lower-energy x-ray photons generated by the tube. Compensating filters, which are external and specially designed, are often affixed to the collimator of the x-ray tube using aluminum. When conducting a specific examination requiring excellent radiographic detail in both "denser" and "less dense" body regions, these filters are employed to confine the primary beam to that anatomical area [25]. Among the compensating filters, the wedge filter is a type used in treatment planning systems. The thicker wedge component is placed in the primary beam, traversing through the less dense portions of the scanned anatomy. Wedge filters are available in three variations: physical, motorized, and dynamic. A physical wedge comprises a wedge-shaped metallic block physically inserted into the beam. A motorized wedge is a permanently mounted physical wedge in the machine head that can be manipulated remotely. In contrast, a dynamic wedge achieves a slanted profile by gradually adjusting one of the collimator jaws during dosage administration. The degree of isodose tilting is influenced by the gradient of the physical wedge filter. The angle of dynamic wedges is determined by the speed of the jaw and the machine dosage rate [10].

2.5.13 Bolus

The Bolus is known as a tissue analogous material that maximises, decreases, or increases radiation dosage in an irradiated region [26]. The thickness of the bolus chosen changes with the intensity of the radiation [27].

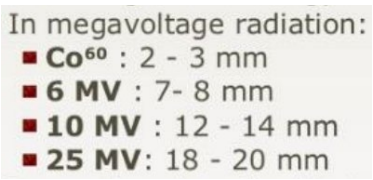

Fig. 4 - thickness of bolus corresponding to the different energy of radiation [27]

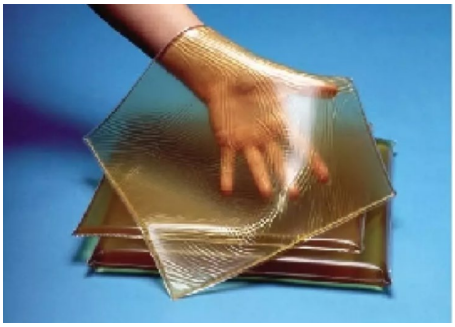

Fig. 5 - Bolus [27]

An optimal bolus has the same electron density, is malleable to fit to the surface, and has the standard specific gravity of 1.02-1.03. Bolus can be made up by different types of materials. The two most prevalent varieties are the cotton soaked with water and paraffin wax. Some other materials to make Bolus are Mix-D, temex rubber, Lincolnshire bolus with sugar and mag carbonate in form of spheres, spiers bolus with rice flour and soda bicarb. During radiation treatment, a thermoplastic bolus material can be utilised to modify the depth of the maximal radiation dosage. When treating diseases such as skin cancer, radiographers may wish to modify the beam such that the greatest dose is delivered directly beneath the skin, where it is most required. As a result, Bolus plays an important role acting as "build-up" material. The orange area (see Fig. 6) represents the tumour, and it is here that the "build-up dosage" should be delivered [28].

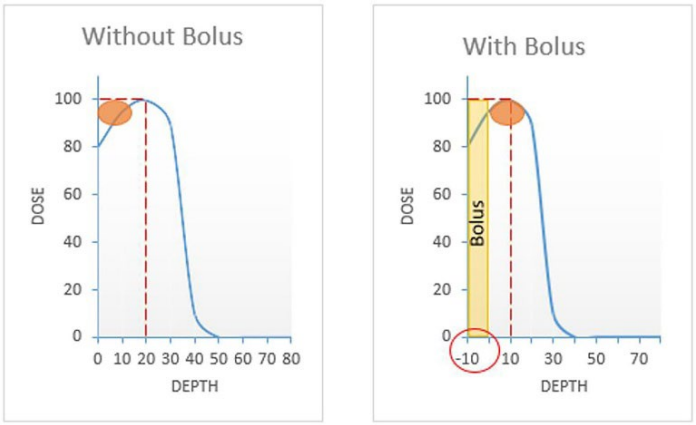

Fig. 6 - Comparison of using bolus and without using bolus [28]

2.5.14 Multileaf Collimators

A multi-leaf collimator is a technology that has numerous sets of metallic leaves (tungsten alloy) that may modify the radiation beam by opening and closing the leaves to generate the shapes. The multileaf collimator is used to direct the beams solely towards cancer cells, sparing normal tissue in the surrounding area. Multi-leaf collimator has the features of eliminating the need for time spent shaping and inserting customized blocks, as well as the hardness of the beam, scattered radiation, and increase in skin doses and doses beyond the field encountered by physical compensators. Besides that, multileaf collimators can also be implemented as dynamic wedges and electronic compensators [29].

2.5.15 Compensating Filters

A compensator is a sort of beam adjusting equipment that equalises out the skin surface shape while keeping the skin sparing benefit. It is basically used to correct the dosage inequalities which caused by the uneven or slanted surface. Compensation can also be employed to account for tissue heterogeneity and dosage inconsistencies caused by lower dispersion at field edges and horns in the beam profile. Equation 11 shows the formula used to calculate the thickness of the compensator [27].

$$\text{Thickness} = \text{TD} \times (\tau/\text{pc}) \tag{11}$$

where TD refers to the deficit of tissue and pc refers to the compensator density. τ/pc can be measured directly by using phantoms. The thickness ratio is affected by variables such as compensator to surface distance, thickness of the missing tissue, field size, depth, and beam quality. When the compensator is situated at a distance away from the skin, its dimensions and form must be altered to accommodate for beam divergence, linear attenuation coefficients of the filter materials and soft tissue, and reduction in scatter at various depths owing to compensating filters [27].

2.5.16 Penumbra

The penumbra is described as the area of sharp dose rate decline near the border of the radiation beam, with the dose rate decreasing as a function of distance to the central axis . Radiation penumbra is a key element in external beam treatment that hinders dose containment to tumour volume and causes unwanted irradiation of normal tissues in the penumbral zone [30].

$$P = [s(SSD + d – SCD)] / SCD \quad (12)$$

where s refers to the diameter of source, SSD refers to the distance of source to skin, d refers to the depth, and SCD refers to the distance of source to collimator. SCD is also the same as distance of source to diaphragm (SDD). The physical penumbra is composed of various elements which are geometrical and transmission penumbra [23]. The transmission penumbra is defined as the area irradiated by photons that have passed through a portion of a collimator. The geometric penumbra is defined as the area that receives only primary photons that are emitted directly from a portion of the source. A geometric penumbra results from the source's size. Geometrical penumbra is affected by the source's size. A huge source has a broad geometrical penumbra. Transmission penumbra arises as a result of the beam coming from the edges of blocks or collimators. It can be reduced by ensuring that the geometry of the focalized blocks accommodate for beam divergence [31].

3. Source of Ionizing Radiations

In oncology treatment facilities for radiation therapy, a high energy linear accelerator (LINAC) is an RF powered system inside a radiotherapy machine (RT) that produces ionising radiation for treatments to kill malignant cells [32]. Medical linear accelerators have a power range of 4 to 25 MeV, can be constructed vertically for lower energies or horizontally for higher energies that need a beam transport system, and can produce high energy electron beams or X-Rays (photon beams). It can ionise the atoms and molecules inside the nucleus of the biological cells in the tissue to which the radiation is given, destroying malignant cells by causing DNA damage.

The clinical procedure that employs ionising radiation treatments to eliminate malignant cells is known as radiation therapy, sometimes known as radiotherapy (RT). It is a significant medical technique for the treatment of cancer. Chemotherapy and surgery are two more treatments for cancer that are frequently employed. Radiotherapy (doses of radiation) is given to more than half of all cancer patients, either alone or in conjunction with surgery or chemotherapy. The radiation therapy's effectiveness comes from its capacity to ionise atoms and molecules inside the nucleus of the biological cells of the tissue to which it is administered, killing malignant cells by causing DNA damage and injuring healthy cells.

The ionising radiation used by the RT machine is produced using a high energy linear accelerator (LINAC), which may also produce high energy electron beams or X-rays (photon beams of an X-Ray linear accelerator). Most radiation therapies in radiation therapy employ X-rays, while a lesser proportion use electron beams or a combination of the two. Specially designed electron beams are utilised for superficial cancers (less than 5 cm deep).

Due to this, many LINAC-based RT machines offer the option of using photon beams in addition to electron beams to treat cancer. They can create photon beams in the 4 to 25 MeV range for X-ray therapy, and the 6 to 25 MeV range for therapeutic electron beams in electron therapy. The LINAC's length varies depending on the ultimate electron kineticenergy, from around 30 cm for 4 to 6 MeV LINACs to about 150 cm for 25 MeV LINACs.

3.1 Constant Radiation Beam

The majority of radiation therapies used in radiotherapy involve X-rays (photon beams), whereas fewer employ electron beams or a combination of the two. For superficial cancers, electron beams are specially employed (less than 5 cm deep). Due of this, many LINAC-based RT machines offer the option of using photon beams in addition to electron beams to treat cancer.

The RT linac machine can be set up in one of two ways. One arrangement, depicted in Figure 1(a), places the LINAC in the gantry of the apparatus perpendicular to the patient. This is the most basic setup for a linear accelerator for cancer treatment (commonly called a medical linear accelerator). It does away with the requirement for a complicated beam transfer mechanism.

For treatments involving photon energy between 4 and 6 MeV, this is frequently used. The longer LINACs, on the other hand, are situated in the gantry of higher energy machines parallel to the gantry axis of rotation, as indicated in Figure 1. (b). The electron beam is then moved from the accelerator to the treatment head for external beam radiation using a complex beam transport mechanism. RT machines that deliver X-ray or electron beams at various energy up to 25 MeV often employ this setup.

3.2 Reference Planning

A dedicated treatment planning system (TPS) is used for both initial treatment planning and online plan adaptation in the clinical introduction of MR-guided radiation with an MR-linac [33]. Treatment planning for an MR-linac is more difficult than for a traditional linac, mostly because of the machine's architecture. Several MR-linac-specific beam and collimator properties must be considered during treatment planning in addition to the existence of a magnetic field. A step-and-shoot IMRT dose delivery method is used because a VMAT dose delivery method is still not available. Dedicated treatment planning methodologies must be created, and the resulting plans must be validated, in order to satisfy all MR-linac specific requirements without affecting plan quality.

4. Conclusion

The purpose of the current paper is set up to determine the treatment planning system in radiotherapy. The analysis of this study has shown that different modern technologies are involved in the planning system. Calculations for different variabilities are crucial so that the dose delivered to the patients is accurate. The development of imaging in radiation therapy treatment planning holds great potential, and additional advancements will help to improve target delineation. To summarize, the future of image-guided treatment planning is limitless, with constant advances leading to improved recovery rates and decreased treatment-associated hazard. Therefore, this would be a fruitful area for further work.

In order to comprehend the role LINAC plays in cancer radiation therapy, this review concentrated on the relationship between ionising radiation and cancer cells. High energy x- rays or electrons are modified by LINAC to fit a tumor's shape and kill cancer cells while protecting surrounding healthy tissue. It has numerous built-in safety precautions that guarantee it will deliver the dose as directed, and a medical physicist regularly inspects it to make sure it is operating properly. LINAC has an important role in radiation therapy to treat cancer specifically.

Acknowledgement

Authors would like to thank the Faculty of Applied Sciences and Technology for facilities provided that make the research possible.

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