



Analysing the Process of Radiotherapy and its Role in Cancer Treatment

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Description

Radiotherapy, also known as radiation therapy, is an essential treatment modality in cancer care. It involves the targeted use of high-energy radiation to kill cancer cells, shrink tumors, and prevent their regrowth. By understanding the intricacies of radiotherapy and its impact on tumors, one can recognise its effectiveness and contribution to improving patient outcomes. The process of radiotherapy begins with a comprehensive treatment planning stage. Advanced imaging techniques, such as Computed Tomography (CT) scans, Magnetic Resonance Imaging (MRI), or Positron Emission Tomography (PET) scans, are utilized to precisely delineate the tumor's location, size, and its relationship with surrounding healthy tissues and organs. Based on the treatment plan, radiation oncologists determine the appropriate radiation dose and delivery technique. External beam radiation therapy is the most common approach, where a linear accelerator delivers radiation beams to the tumor site from outside the patient's body. This non-invasive technique allows for precise targeting while sparing adjacent healthy tissues as much as possible. Another technique, known as brachytherapy, involves the placement of radioactive sources directly into or near the tumor, delivering a highly concentrated dose.

Simulation plays a vital role in radiotherapy planning. It involves developing a replica of the patient's treatment position and immobilizing those using customized devices. This ensures consistent and accurate radiation delivery during each treatment session. Specialized software assists in contouring the tumor and adjacent organs, aiding in dose calculation and treatment plan optimization. The treatment delivery phase involves daily sessions called fractions, spread over several weeks. These fractions are carefully scheduled to maximize the therapeutic effect while minimizing damage to healthy tissues. Patients receive radiation therapy in a designated treatment room, positioned comfortably in the same position as during simulation.

The linear accelerator is precisely adjusted to deliver the prescribed dose based on the treatment plan. Modern techniques, such as Intensity-Modulated Radiation Therapy (IMRT) and Image-Guided Radiation Therapy (IGRT), allow for even greater precision and real-time monitoring of the tumor position during treatment. Radiotherapy plays a vital role in cancer treatment across various stages and scenarios. It can be used as the primary treatment, adjuvant treatment after surgery, or palliative treatment to relieve symptoms in advanced cancers.

As a primary treatment, radiotherapy aims to eradicate cancer cells in situations where surgery is not feasible or effective. It is commonly used for tumors that are localised, such as in early-stage lung cancer or prostate cancer. Radiotherapy alone or in combination with chemotherapy can achieve excellent tumor control rates, potentially leading to a cure. In the adjuvant setting, radiotherapy is administered after surgery to eliminate any residual cancer cells and reduce the risk of local recurrence. This is often seen in breast cancer, where radiotherapy is used to target the remaining breast tissue after a lumpectomy or to treat the chest wall after a mastectomy. Adjuvant radiotherapy significantly improves local control and overall survival rates.

Additionally, radiotherapy plays an important role in palliative care, providing relief from cancer symptoms and improving the quality of life for patients with advanced or metastatic disease. Palliative radiotherapy can effectively alleviate pain, reduce tumor size, and alleviate symptoms caused by tumor compression or infiltration of nearby structures. It helps restore functionality, allowing patients to maintain independence and engage in daily activities with greater comfort. Radiotherapy can also be combined with other treatment modalities to enhance overall treatment efficacy. It is frequently used in combination with chemotherapy, known as chemo radiotherapy, to achieve better tumor control and improve survival rates in various cancers. The sequential use of radiotherapy and targeted therapies is also gaining prominence, with radiotherapy sensitizing tumors to the effects of targeted drugs, thus enhancing treatment outcomes.

Conclusion

The process of radiotherapy, from planning to delivery, is a complex and highly precise treatment modality that plays a significant role in cancer treatment. By utilising advanced imaging, meticulous treatment planning, and cutting-edge delivery techniques, radiotherapy effectively targets and destroys cancer cells while minimising damage to healthy tissues. Its applications span across different stages of cancer, providing curative potential as the primary treatment, reducing the risk of recurrence as adjuvant therapy, and improving quality of life as palliative care. With continuous advancements, radiotherapy continues to evolve and contribute to the fight against cancer, providing hope and improved outcomes for patients worldwide.

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