Radiopharmaceuticals: Cancer Therapy

Pushkin Rathore 18111043

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The aim of this is paper is to make aware the reader about the technologies that exists that make the treatment of certain diseases such as cancer to be more efficient by the use of different approaches. In this particular case, we'll look into the dealings in regards to the radioactive substances and the science behind them that is being applied to treat diseases such as cancer. Radiopharmaceuticals, or medicinal radio compounds, are a group of pharmaceutical drugs containing radioactive isotopes. Radiopharmaceuticals can be used as diagnostic and therapeutic agents. Radiopharmaceuticals emit radiation themselves, which is different from contrast media which absorb or alter external electromagnetism or ultrasound. Radiopharmacology is the branch of pharmacology that specializes in these agents. The main group of these compounds are the radiotracers used to diagnose dysfunction in body tissues. While not all medical isotopes are radioactive, radiopharmaceuticals are the oldest and still most common such drugs. Radiation therapy was first used to treat cancer more than 100 years ago. About half of all cancer patients still receive it at some point during their treatment. And until recently, most radiation therapy was given much as it was 100 years ago, by delivering beams of radiation from outside the body to kill tumors inside the body.

Week 4

Mechanism and biological effects the mechanism of action for RPT is radiation-induced killing of cells. Investigation into the effects of radiation on tissues and tumours began soon after the discovery of radiation and radioactivity. RPT has the benefit of drawing on the substantial knowledge base of radiotherapy. However, RPT differs from radiotherapy, and it is important to understand how those elements unique to RPT influence therapy. The essential questions for RPT are where does the agent localize and for how long? As noted in the section entitled 'Dosimetry', answers to these questions inform the tumour versus normal tissue absorbed dose and provide a measure of potential treatment success. The biological effects of a given absorbed dose for a tumour depend on the rate at which the dose is delivered. A dose of 30 Gy delivered to a tumour over a period of many weeks at a dose rate that is exponentially decreasing, as is typically the case with RPT, will have a very different effect from that of the same amount delivered at the much higher dose rates used in radiotherapy (for example, daily, 2- Gy fractions over 15 days). The difference in biological outcome will depend on the biological repair and radiosensitivity properties of the tumour. Dose- rate considerations also apply to normal organs.

Another fundamental distinguishing feature important for understanding this treatment modality is the diminishing curative potential with reduced target cell number. In radiotherapy the probability of killing all cells for a given absorbed dose increases as the number of target cells decreases — fewer cells to kill for a given radiation absorbed dose increases the chance that all of the cells will be killed. By contrast, fewer cells do not translate into a greater tumour control probability in RPT. This is because the radiation is not delivered uniformly to all cells. If the emitted radiation originates from a radionuclide on the surface of tumour cells, fewer cells lead to a smaller fraction of the emitted energy being deposited into the targeted cells14. This is balanced, in part, by the greater concentration that may be achieved in smaller clusters of cells relative to large measurable tumours.