Radiopharmaceuticals: Cancer Therapy

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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.

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A variety of reasons for the progression and shift to different radionuclides may be invoked to explain the changes and additions of the different β- particle emitters used over time. For example, in an early theoretical evaluation of different radionuclides, yttrium-90 ranked second to rhenium-186 in a list of nine radionuclides considered. In that ranking, the main criterion was the tumour to non- tumour- absorbed dose ratio. This was a theoretical calculation obtained for different radionuclides using typical radiolabelled antibody pharmacokinetics for tumour targeting and organ clearance. This optimum reflected the 64.2- hour half- life of yttrium-90 and its high- energy β- particle, which was deemed favourable for uniformly irradiating tumours. Like iodine-131, the adoption of yttrium-90 for RPT is likely based on its history and widespread availability. In the 1970s it was used in colloidal form, primarily to treat rheumatoid conditions. Efforts to conjugate yttrium-90, a radiometal, were unsuccessful until a radiometal conjugation chemistry that retained stability in vivo was developed. Clinical trials using yttrium-90- labelled antibodies as RPT agents initially focused on ovarian cancer and subsequently on haematological cancers, as well as radiopeptide therapy. Yttrium-90 continues to be a popular radionuclide for RPT because of the clinical

impact of yttrium-90- impregnated microspheres that are used for treatment of hepatic metastases. Although yttrium-90 has been imaged, imaging generally requires high activities (more than 300 MBq). Such activities are typically achieved only in microsphere therapies. Lutetium-177 gained popularity because it emits photons in the 100–200- keV optimal imaging range and has a β- particle energy that is between that of iodine-131 and yttrium-90, which is appropriate for therapy. These factors, along with a half- life that is compatible with the pharmacokinetics of both antibodies and peptides, make this radionuclide a theranostic in that the same radionuclide may be used to assess tumour uptake and the extent of cancer, and also as a treatment. It is produced in a reactor and is therefore widely available, with a relatively straightforward conjugation chemistry.