Radiopharmaceuticals: Cancer Therapy

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Week 9

March 18th, 2022

AIM

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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The success of iodide-131 in targeting and treating thyroid disorders and carcinomas encouraged the expansion of its use in a variety of cancers through its incorporation into targeting vectors. For example, iobenguane I-131 is the radioiodinated small- molecule meta- iodobenzylguanidine ([131I]mIBG), an analogue of the adrenergic neutrotransmitter noradrenaline that is used to treat patients with neuroblastomas140 142. Iodide-131 can be introduced to targeting vectors as a highly reactive electrophilic iodine compound, allowing rapid iodination of molecules containing activated aromatic groups, or through displacement by nucleophilic attack of the radioiodide143. mIBG radiolabelled with high- specific- activity iodine-131 was recently approved by the FDA for the treatment of adult and paediatric patients aged 12 years or older with unresectable metastatic phaeochromocytoma or paraganglioma. No FDA approved therapy was available for these conditions before approval of this agent. Use of this agent requires a positive mIBG imaging scan, standard, weight- based therapeutic dosing and the application of a process for individualized dosimetry using a pretreatment tracer study to calculate absorbed doses for normal organs. Normal organ dosimetry is used to adjust the activity administered so that the organ doses are below

specified threshold levels. FDA approval of this agent was based on the substantial pre-existing experience with [131I]mIBG144–151 and on a recent phase I study which yielded 1- year and 2- year overall survival of 85.7% and 61.9%, respectively, in 21 patients treated with the maximum tolerated dose152. Clinical trials using this agent are ongoing (NCT03561259 and NCT02378428).