Radiopharmaceuticals: Cancer Therapy

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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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Nano construct and microsphere RPT Yttrium-90 radioembolization is a technique that targets radiolabelled microspheres to liver tumours associated with unresectable hepatocellular carcinomas or metastatic liver tumours from primary colorectal cancer. Liver tumours derive their blood supply from the hepatic artery, whereas the normal liver derives its blood supply from the portal vein, allowing targeted delivery of 90Y-loaded microspheres via intra- arterial injection. The commercially available 90Y-loaded microspheres are either glass based (TheraSphere) or resin based (SIR- Spheres), differing in size, number of microspheres injected and activity per microsphere. Both agents were approved by the FDA and are marketed as devices. We include these as RPT agents because they better fit the broad definition of RPT agents provided earlier. The findings of studies comparing 90Y- loaded glass- based and resin- based microspheres are conflicting and further investigation is needed.

For example, while one study in patients with unresectable hepatocellular carcinomas found a significantly higher overall survival for treatment with 90Y- loaded glass microspheres compared with 90Y- loaded resin microspheres, another study found a

similar outcome in terms of progression- free survival and overall survival between patients treated with 90Y- loaded glass- based microspheres and patients treated with 90Y- loaded resin- based microspheres. Additional transarterial radiotherapeutics are being explored, including phosphorus-32 glass microspheres and holmium-166 microspheres as well as 131I- labelled or 188Re- labelled iodized oil. Initial clinical trials of 131I- labelled iodized oil (131I- labelled Lipiodol) were completed in the late 1980s/ early 1990s and clinical investigations of this treatment modality continued until 2013. Administration of 131I- labelled Lipiodol in the adjuvant setting, after resection or radiofrequency ablation for hepatocellular carcinoma, yielded a 6- month increase in recurrencefree survival and a 24- month increase in median overall survival. In a prospective randomized 43- patient trial, adjuvant treatment of patients with hepatocellular carcinoma led to a significant increase in overall survival at 3 years of 86.4% in the treated group versus 46.3% in the control group. At both the 5- year follow-up and the 10- year follow- up, actuarial overall survival in the treated group was statistically significantly greater than in the control group (66.7% versus 36.4%, respectively, and 52.4% versus 27.3%, respectively). The difference in overall survival lost statistical significance 8 years after randomization.