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1A Review: “Radiopharmaceuticals for Therapeutic and Diagnostics Application”

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ABSTRACT

A radiopharmaceutical is a preparation intended for in-vivo use that contains a radionuclide in the form of a simple salt or a complex. It may exist as a solid, liquid, gas or a pseudo gas. The chemical and physical identity and a form of a radiopharmaceutical are very important because in each case, once administered the radiopharmaceutical is intended to target certain tissues, binding sites, biochemical pathways.

Keywords : Radiopharmaceutical, radionuclide, pseudo gas, binding sites.

INTRODUCTION

By definition a radiopharmaceutical is a radioactive pharmaceutical agent that is used for diagnostic or therapeutic procedures. Over the past three decades the discipline of nuclear pharmacy or radio-pharmacy has become highly specialized and contributed positively to the practice of nuclear medicine.

HISTORY AND GROWTH

Radiopharmaceuticals are medicinal formulations containing radioisotopes which are safe for administration in humans for diagnosis or for therapy. Definitions and Terminology

Radioactivity: The phenomenon of emission of radiation owing to the spontaneous transformation or disintegration of the radionuclide is known as 'Radioactivity'. Units of Radioactivity

THERAPEUTIC APPLICATIONS

Therapeutic Radiopharmaceuticals are radio labeled molecules designed to deliver therapeutic doses of ionizing radiation to specific diseased sites. Therapeutic applications of radiopharmaceuticals have emerged from the concept that certain radio nuclides possessing particulate emission such as alpha and beta radiations or low-energy low-range electrons (Auger electrons) possess the ability to destroy diseased tissues.

A few examples of how radioisotopes are used for therapeutic purposes.

Non-Hodgkin's Lymphoma Therapy

Therapeutic treatments are given using a radioisotope attached to an antibody to deliver radioactivity to specific cells are called radio immunotherapy (RIT).

3.1 Radiopharmaceuticals for Radiosynoviorthesis

Radiosynoviorthesis or radio synovectomy is a technique wherein a radiopharmaceutical is delivered into the affected synovial compartment (the interior of joints that is lubricated by fluid) of patients suffering from joint pain, as in the case of rheumatoid arthritis.

3.2 Palliative Treatment of Bone Metastasis

Various radioisotopes and pharmaceuticals are used to deliver palliative treatment of bone metastases, including samarium-153 (Sm-153), strontium-89 (Sr-89) chloride, and phosphorus-32 (P-32) sodium phosphate.

3.3 Non-Hodgkin's Lymphoma Therapy

Therapeutic treatments are given using a radioisotope attached to an antibody to deliver radioactivity to specific cells are called radio immunotherapy (RIT).

3.4 Diagnosing and treating disease in children

In most countries, nuclear medicine diagnostic and therapeutic applications have become mature technologies by now.

4. Diagnostic Radiopharmaceuticals

Every organ in our bodies acts differently from a chemical point of view. Doctors and chemists have identified a number of chemicals which are absorbed by specific organs. The thyroid, for example, takes up iodine, the brain consumes quantities of glucose, and so on. With this knowledge, radio pharmacists are able to attach various radioisotopes to biologically active substances.

DIAGNOSTIC NUCLEAR IMAGING AGENTS

^{99m}Tc-Labelled Radiopharmaceuticals Many ^{99m}Tc-containing radiopharmaceuticals have become available for clinical use, including perfusion agents for the heart [^{99m}Tc-MIBI (Cardiolite®)] and the brain [^{99m}Tc-ECD (Neurolite®) and ^{99m}Tc- HMPAO (Ceretek®)], as well as an agent that images renal function (^{99m}Tc-MAG3)²⁵.

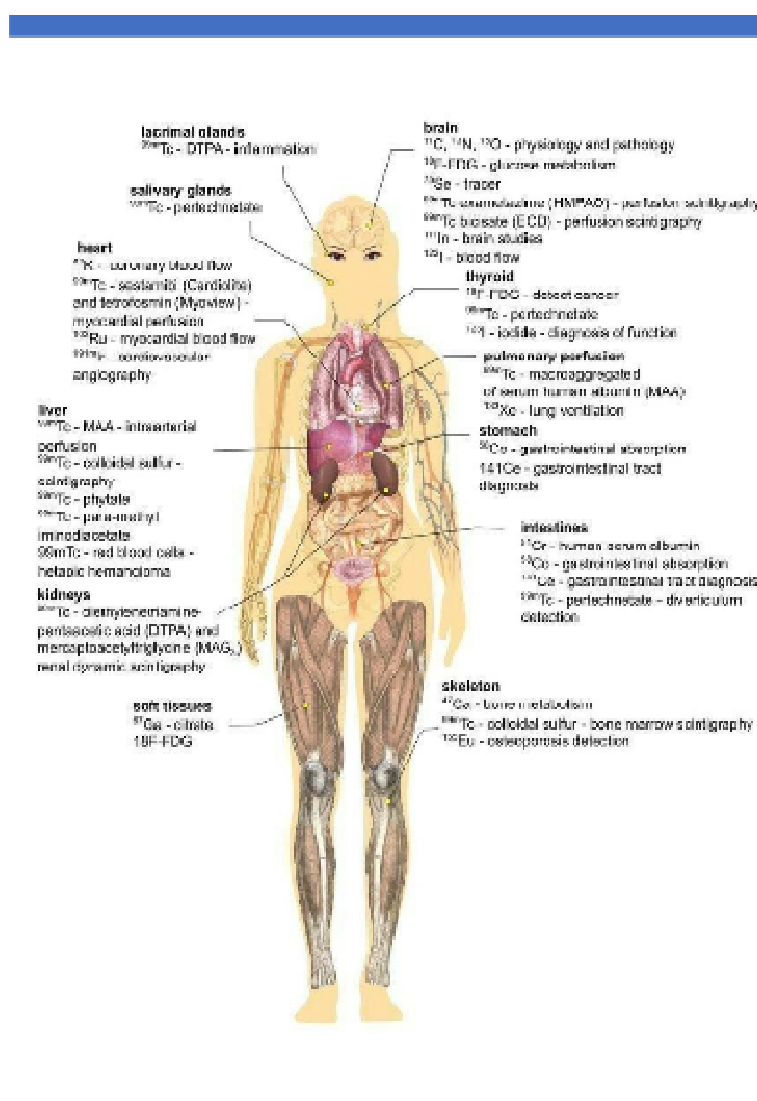


Fig. No. 1. Different Radiopharmaceuticals And Target Organs

^{99m}Tc-HMPAO (^{99m}Tc-hexamethyl-propylene amine oxime) ^{99m}Tc-HMPAO is a lipophilic compound with the ability to cross the BBB and to accumulate in the brain proportional to blood.

Iodine Labelled Radiopharmaceuticals

Folate Conjugates

The folate receptor or folate binding protein is attractive as a potential molecular target for II delivery, since it is overexpressed by a number of tumour cell types (e.g., breast, ovarian, cervical, colorectal, renal and nasopharyngeal), but shows only limited expression in normal tissues¹⁶.

Iodine-123 (123I)-Labelled Fatty Acids

123I-labelled fatty acids detect an ischemic myocardium. The normal cardiac muscle uses fatty acid metabolisms its main source of energy; the ischemic myocardium switches to glucose metabolism.

123I Metaiodobenzylguanidine (123I-MIBG)

Meta-iodobenzylguanidine a structural analogue of guanidine, is an adrenergic blocking agent. Like guanidine, MIBG enters the adrenergic tissue and is concentrated in the catecholamine storage vesicles of adrenergic nerve endings and the adrenal medulla.

Indium Labelled Radiopharmaceuticals

[Indium-111-(111In)-DTPA] Octreotide Peptides have fast clearance, rapid tissue penetration and low antigenicity and can be produced easily.

Diagnostic Radiopharmaceuticals

Dysprosium 165 (2 h) used as an aggregated hydroxide for synovectomy treatment of arthritis.

Floufine 18 Asfluoro2 Deoxy D-Glucose (fdg) used for cerebral, myocardial and tumor glucose metabolism.

Holmium 166 (26 h) being developed for diagnosis and treatment of liver tumors.

Iron 59 (46 d) as ferric chloride solution used in studies of iron metabolism in the spleen.

Lofetamine HCl 123 commonly known as IMP used for noninvasive evaluation of local cerebral blood flow in cerebrovascular accidents.

Oxygen15 as H₂¹⁵O in equilibrium studies of tissue water content and as a tracer for regional blood flow.

5 .DIAGNOSTIC RADIONUCLIDE IMAGING

Nuclear medicine imaging is considerably more sensitive than most other imaging modalities [X-ray, CT(computerized tomography), MRI (magnetic resonance imaging)] for identifying the presence and extent of malignancy, since biochemical changes monitored by positron emission tomography (PET) and single photon emission computed tomography(SPECT) generally precede anatomical changes.

Radionuclide Brain Imaging (RNBI)

Delivery of diagnostic agents to the central nervous system (CNS) poses several challenges as a result of the special features of CNS blood vessels and tissue fluids. Differentiation of active neoplasm from tumours of mal-developmental origin,

Verifying uptake at diagnosis so the method can be effectively used during follow-up, or,

Prognostic grading of the tumour that will complement information obtained from histopathological study.

Labelling and Packaging Labelling

The label on the container should state:

The name of the product and the name of the radionuclide;

Any product identification code;

The name of the manufacturer;

An identification number (batch number);

Packaging

The suitability of packaging material for the product and for the labelling procedure to be carried out should be described. It may be necessary to describe special radiation shielding.

Package leaflets

Package leaflets play a particularly important role for semi manufactured Products such as preparation kits and should include:

The name of the product and a description of its use;

A list of the contents of the kit;

The name and the address of the manufacturer of the kit;

STORAGE

Store in an airtight container in a place that is sufficiently shielded to protect personnel from exposure to primary or secondary emissions and that complies with national and international regulations concerning the storage of radioactive substances. During storage, containers may darken due to irradiation. Such darkening does not necessarily involve deterioration of the preparations.

SUMMARY & CONCLUSION

Nowadays there are different types of radiopharmaceuticals are available and having an important role in diagnosis of disease. Recently, however, there has been a significant growth of this branch of nuclear medicine with the introduction of a number of new radionuclides and radiopharmaceuticals for the treatment of metastatic bone pain, neuroendocrine and other tumours.

REFERENCES

- 1) Debnath S, babul MN, Kumar GV. Radiopharmaceuticals and their Therapeutic Applications in Health Care System. Asian Journal of Research in Pharmaceutical Science. 2015;5(4):221-6.
- 2) Dar, Mohammad, Mubashir Masoodi, and Saeema Farooq. "Medical uses of Radiopharmaceuticals." PharmaTutor 3.8 (2015): 24-29
- 3) Selcan TÜRKER*, A. Yekta ÖZER* Diagnostic radiopharmaceutical agents Article in Fabad Journal of Pharmaceutical Sciences · September 2004
- 4) Ivertion radiopharmaceutical" in chery :et al. (edc),AMA manual of style (10th ed)oxford oxfordshire: university oxford university press,ISBN 978-0-19-515633-9 Cutler CS, Lewis JS, Anderson CJ. Utilization of metabolic, transport and receptor-mediated processes to deliver agents for cancer diagnosis, Adv. Drug. Del. Rev., 37, 189-211, 1999.
- 5) Callahan RJ, Dragnetakes SC. The role of the practice of Nuclear Pharmacy in positron emission tomography, Clin. Posit. Imag., 2, 211-216, 1999.
- 6) Erdoğan S, Özer AY, Ercan MT, Aydın K, Hıncal AA. Biodistribution and computed tomography studies on iopromide liposomes, STP Pharma Sci., 8, 39-43, 1998.
- 7) Yazan B, Özer AY, Hıncal AA. The methods used for quality control of 99mTc-(V)-DMSA, H.Ü.Ecz. Fak. Der., 16, 73-85, 1996.
8<http://nuclearpharmacy.uams.edu/RPLIST.html> (22-11-2019)
- 8) Buck A, Yonekawa Y. PET imaging in cerebrovascular disease. Chapter 10, von G.K. Schulthess (ed), Clinical Positron Emission Tomography, Lippincott Williams and Wilkins,
- 9) Philadelphia., Buck A, Yonekawa Y. Clinical Positron Emission Tomography (PET), Correlation with morphological cross-sectional imaging, Lippincott Williams & Wilkins, Philadelphia, 123-136, 2000.