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MEDICAL LABORATORY SCIENCE

MLS 314

**RADIOACTIVE TRACERS**

A radioactive tracer or radioactive label is a chemical compound in which one or more atoms have been replaced by a radionuclide so by virtue of its radioactive decay it can be used to explore the mechanism of chemical reactions by tracing the path that the radioisotopes follows from reactants to products. It can also be defined as a radioactive element or compound added to a material to monitor the materials to monitor the materials distribution as it progresses through a system. The use of a radioactive tracer is called radiolabeling which is one form of isotopic labelling.

Radioactive tracers utilize the positive qualities of radioactivity, the ability to emit a signal, while minimizing the negative effects. Isotopes use elements with a short half-life to reduce the dangers of radioactive exposure to the patient. A half-life represents the amount of time it takes for one-half of a substances radioactivity for decay, For example, a material with a half-life of six hours will lose half of its radioactivity in six hours then another one-fourth of its strength. The shorter the half-life the less the radioactive exposure.

The most common radioactive isotope used in radioactive tracers is technetium-99m, used in almost 30million procedures representing 80 percent of all nuclear medicine procedures, according to World Nuclear association. It is an isotope of an artificial element, technetium, with a half-life of six hours which provides enough time to perform the necessary diagnostic procedures, but provides patient safety. It is versatile and can be targeted to a specific organ or body part and emits gamma rays that provides the necessary information. Other radioactive tracers include iodine-131, for thyroid conditions, iron-59 to study metabolism in spleen and potassium-42 for potassium in the blood.

USES OF RADIOACTIVE TRACERS

Radioactive tracers forms the basis of some medical imaging systems such as PET scans. Radiolabeling is used in research to trace the path of element in biochemical reactions and cells. Radioisotopes are also used to track the flow of fluids, particularly in the petroleum and natural gas industry

1. CT SCANS: A major use of radioactive tracers involves computed x-ray tomography or CT scans. These scans constitute approximately 75percent of medical procedures with tracers. The radioactive tracer produces gamma rays or single photons that a gamma camera detects. Emissions come from different angles and a computer uses them to produce an image. The treating physician orders a CT scan that targets a specific area of the body like neck or chest or a specific organ like the thyroid.
2. PET: Positron emission tomography, or PET, represents the latest technology to use radioactive tracers. It provides a more precise image and is used frequently in oncology with flourine-18 as the tracer. PET is also used in cardiac and brain imaging with carbon-11 and nitrogen-13 radioactive tracers. Another innovation involves the combination of PET and CT into two images known as PETCT.

**APPLICATION OF TRACER IN MEDICINE**

Diagnostic techniques in nuclear medicine use radioactive tracers which emits gamma rays from within the body, these tracers are generally short lived isotopes linked to chemical compounds which permits specific physiological processes to be scrutinized. They can be given by injection, inhalation or orally. The radioactive atoms that are radioisotopes have brought a lot to biology. They are also at the core of nuclear medicine. These unstable atoms behave like ordinary stable atoms apart from the one and extremely short moment when they emit their radiation. Their chemical and physical properties are those of the specie to which they belong, they bind like them with other atoms to form molecules. The alpha, beta, or gamma rays they emit during their fugitive radioactive decay signal their presence.

Tiny objects of the small infinitely small radioisotopes are innumerable even in minute proportion in matter. In therapy the rays are used as weapons, one would shell tumors with an external source or by means of radioactive implants located near the malignant cells. The use of radioisotopes for diagnosis is by far the most widespread

In the areas of medicine nuclear tracers are usually radiopharmaceutical products whose molecules contains a radioactive element. The emissions of radiations by such atoms allows to follow the path or the metabolism of these tracers in the body. Medical tests of this kind involves administering a radioactive tracer, chosen carefully for its ability to follow a metabolism or provide information about the working of a given organ, The tracer can be an individual atom (e.g. iodine 123) a marked molecule such as diphosphonate marked with technetium 99m, an hormone or even an antibody marked with an isotope .The isotope has to be chemically attached to the relevant molecule without altering its properties and metabolism, the bond must also be a solid one in order to follow the molecule and not eventually shaken off radioactive atom.