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Letter to Editor

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NOVEL MRI RADIOPHARMACEUTICALS SUGGESTED FOR MOLECULAR IMAGING

Mehdi Shafiee Ardestani

Department of Radiopharmaceutical and Medicinal Chemistry, Tehran University of Medical Sciences (International Campus), Tehran, Iran

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MRI & MOLECULAR IMAGING

Human beings are in need of technologies which are able to show the beginning and the progression of disease. An early diagnosis helps physicians have more impact in treating it and in follow up. A greater proportion of diseases involved in unknown and complicated disorders are being diagnosed and treated in the field of human health using the imaging technologies.[1]

Today, molecular imaging is one of the most successful methods for the non-invasive screening of complex disorders at the earliest stage.[2-6]

Molecular imaging is a branch of medical imaging science that aims to detect, localize, and monitor critical molecular processes in cells, tissue, and living organisms using highly sensitive instrumentation and contrast mechanisms. This area of medical imaging has developed alongside the emergence of molecular medicine, in which the genetic makeup of each patient factors into treatment planning. Through the use of gene analysis, it is possible today to identify patients that are prone to specific diseases, and consequently, novel chemotherapeutics have been developed to target specific disease biomarkers. This treatment strategy spares healthy tissue and maximizes therapeutic efficacy of the drugs. Critical to the success of molecular medicine is molecular imaging, which is not confined to the traditional silos of imaging specialties such as computed tomography (CT), magnetic resonance imaging (MRI), single photon emission tomography (SPECT), positron emission tomography (PET), ultrasound imaging, and optical imaging methods. Instead, molecular imaging is a multidisciplinary endeavor that harnesses the expertise of diverse scientists, engineers, and clinicians. Chemists, in particular, play a critical role in this effort.[7]

For many years, nuclear medicine technologies have been the most common and most successful methods of non-invasive screening.[1]
Apart from the high costs and the exposure of patients, and potentially medical staff, to radioactive radiation, the powerful and highly accruing nature of nuclear medicine instruments in the diagnosis of disorders makes them strong and sensitive tools for physicians, especially in oncology.[1]

However, nuclear medicine researchers believe that MRI in metabolic/physiological/gene expression, generally molecular imaging is severely restricted and, as a result, the expensive but powerful method of PET has been widely utilized worldwide instead.[2]

When compared to other imaging modalities, the main advantage of MRI is its super-spatial resolution whereas its major drawback is represented by the limited sensitivity of its probes. Thus, chemistry is strongly challenged to find solutions able to improve the probe's response in order to enhance the role of MRI in the field of molecular imaging applications.[8]

The production and biomedical application of *in vivo* bio-molecular sensing MRI metabolic contrast agents has recently become one of the great universal research interests and has even achieved great success.[3-6]

Temperature, redox potential, enzyme activity, free radical/metal ion responsive, targeted nanocarriers and/or pH sensitive molecular metabolic MR contrast agents are among the most famous examples which promote the contrast enhancement ability of MR imaging for distinguishing molecular metabolic/gene expression features.[3-6]

Overall, these MRI contrast agents provide a framework for achieving a higher degree of propriety for MRI as a low cost, highly available and sensitive biomedical tool that does not require the use of radioactive radiation. It has been suggested that MR molecular imaging is the new opponent to PET in nuclear medicine imaging.

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For correspondence:

Mehdi Shafiee Ardestani

Assistant Professor of Radiopharmaceutical Sciences

R & D & Q.C. Consultant & Hepatitis B Department. Production & Research Complex, Pasteur Institute of Iran, Tehran, Iran

Department of Radiopharmaceutical and Medicinal Chemistry, Tehran University of Medical Sciences (International Campus), Tehran, Iran

Tel/Fax: 0261-3520722

Email: shafieeardestani@gmail.com