

Theranostic Science Development With NMR/MRI/Radioligand Study; A Call for Collaborative Research in Target Delivery

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I. INTRODUCTION

There has been a wide spread in the cases of cancer in the recent decades with different types of cancers emerging every decade (Yang et al, 2018), management has evolved from great study with the discovery of chemotherapeutic agents. However, the adverse effects from these chemotherapeutic agents and chemotherapy (irradiation) have pointed the needs for more targeted drug discovery. In the last decades, development of targeted drug delivery via monoclonal antibodies and others has helped sharpen the management of cancer.

It is however necessary not to limit treatment but also help the diagnosis and treatment simultaneously. The delivery of appropriate diagnosis with the further therapeutic treatment of the targeted tissue is the scope of Theranostic science. (Ziwei et al, 2021) In target delivery system, it is functional to determine the specific receptor or tissue that needs a particular dose of the drug, the specificity will not be considered complete if there is wrong diagnosis or wrong selection of the targeted tissue or receptor.

II. BACKGROUND

The burdens or cases of cancer come with multiple pains and deformation, and it is of note that the drugs generally available are not specific enough, thus resulting to more pain or adverse effects. In the last four decades, there have been great developments in the research and production of nuclear magnetic resonance (NMR), the development has further opened the discovery of Magnetic Resonance Imaging (MRI) which opened door for extensive diagnosis and treatment. (Kauppinen & Peet 2011)

Greater exploration of radiopharmaceuticals has been used in the development of different diagnostic tools, and other chemotherapy, such as computerized tomography (CT), Single Photon emission computed

tomography (SPECT), Positron emission tomography, PET etc. These imaging techniques opened door for theranostic science.

III. THERANOSTIC SCIENCE, FURTHER NMR DEVELOPMENT

As Theranostic science deals with the diagnosis and treatment of the disease condition, the tools discover the presence of malformation in tissues, and also capable of correcting or removing such malformation immediately. This is a breakthrough in targeted treatment delivery, the accuracy of diagnosis is improved and the lethal dose is targeted to the right tissue.

There is a greater need to marry the function of developed NMR, developed ligand molecule and the radiopharmaceutical function for the delivery of the lethal dose. Likewise, it is important in the future, that with this greater knowledge of NMR, we will be able to discover the stroma responsible for the cancerous growth and target such alone just like that of prostate cancer was identified "PCa". (Luis et al, 2022)

The stance that NMR has to play is great, not only limited to structural elucidation but also goes further to molecular transformation, gene study, receptor skeletal study and lots more. In protein PCR, structural information can be determined and many larger scopes at the molecular level

IV. CONNECTION WITH NMR

In the presence of a magnetic field, molecules with magnetic properties can absorb quantized energy moving to higher energy state, thus this energy gap through lamour frequency is quantized. If such molecule is moved to another chemical environment, there will be a change in the energy gap of absorption, and as such, it is on this basis that MRI

was formed, because there will be different frequency displayed by a molecule in a different chemical environment.

$$\Delta E = h\nu$$

The information from this NMR, can be used to develop complex machine like MRI for diagnostic function, because of different behavior at the molecular level; when such molecule of a tissue is exposed to magnetic field will be different from another tissue. There can be a similarity with tissue of similar chemical environment, a closer look into their behavior will give a better image.

Receptor pharmacology open room for the study of affinity to a chemical entity, NMR scrutinizes the structure of the compound, and affinity will be of clearer picture craving way for a robust system biology. In the presence of a magnetic field, the induction and generation of magnetic field by molecule can be a characteristic tool in the development of both diagnostic tool and lethal dosing molecule. Targeted delivery will overcome the complex barrier of non-selectivity and narrow the game to individualized therapy. (Niall et al, 2014)

A connective web of structural elucidation will create more ligand with high pharmacokinetic profile and affinity, and which intuitively can be potential drug or delivery system for radiopharmaceuticals. In the moiety with robust chelator of higher dissociation constant only at the receptor site, and structurally nontoxic before reaching receptor site. All these games can be elucidated with NMR tools or NMR provides a tracer for implantable detector. (Deborne et al, 2024)

As molecule possess different energy gap at healthy state and diseased state, a distinctive treatment can be given on the difference of their energy gap when in the presence of a magnetic field.

The future research in theranostic science will definitely be a collaborative move toward the different energy gap in molecules while in different chemical environment, this taking further the discoveries of NMR sciences into the field of radiopharmaceuticals and ligand development will give us clearer picture about having diagnosis and treatment done simultaneously, which is the hallmark of targeted treatment especially while cancer and other infectious diseases are taken into

consideration. The collaborative call is thus extended to the field of receptor pharmacology, NMR spectroscopic development, organic and synthetic chemistry, system biology, physics, mathematics, radiopharmacy, pharmacokinetics, molecular genomics, analytical chemistry, among others to join force in our search for clearer imaging, targeted and theranostic science delivery.

V. CONCLUSION

Theranostic science development in cancer management alongside the management of other infectious diseases is a collaborative field of research; calling all stakeholders to join force and work together. The molecular and receptor study of the cancer cells and stromas can be highly identified using NMR tools (MRI and others) creating the development of the NMR in the theranostic science and Nuclear medicine for targeted delivery.

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