Editorial

^{188}Rhenium, the New Workhorse of Radio Nuclide Therapy: Concepts to Clinical Use

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In 1925, the pioneering German chemists Ida Tackeand Walter Noddack announced the discovery of element 75 and named this new element rhenium in honor of the river Rhine (Latin Rhenus) [1]. The couple would later marry and continue their influential work as a team for the remainder of their professional careers. Remarkably, the pair also made valuable contributions to the discovery of technetium, which along with rhenium were the last two missing elements of the main periodic table at the time [1]. Both these elements belong to group 7 of the periodic table and thus share similar chemistry. Being suitable for therapeutic and diagnostic purposes respectively, ^{188}Re and ^{99m}Tc therefore represent an ideal theranostic radionuclide pair. It now seems particularly fitting that the current partnering of these two radionuclides in a theranostic model stems from the discoveries of two partnering chemists almost a century ago.

^{188}Re($T_{1/2}$17 hours) has excellent physical properties as a therapeutic radionuclide. The high energy β emission($E_{\beta\ max}$2.12 MeV)has a maximum range of 10.4 mm and the accompanying 155 keV energy gamma emission (15% abundance) facilitates imaging for biodistribution anddosimetry assessment [2]. In addition, the on-demand availability of ^{188}Re from the tungsten-188(^{188}W)/^{188}Re generator can potentially allow daily clinical access in a cost effective manner per unit dose [3]. These attractive properties of ^{188}Re have been utilized in several clinical applications over the last three decades including intra-arterial therapy of hepatocellular carcinoma, treatment of metastatic bone pain and radiosynoviorthesis [4-6].

In 2008 under the visionary guidance of Dr. Ajit Padhy, the International Atomic Energy Agency (IAEA) sponsored a multinational trial investigating the safety and efficacy of intra-arterial ^{188}Re lipiodol in the treatment of inoperable hepatocellular carcinoma (HCC) [4]. This large phase II study involving 185 patients demonstrated that ^{188}Re lipiodol therapy was feasible, safe and had promising efficacy with 78% of patients achieving either stable disease or objective response. This study was made possible only after decades of research from many dedicated scientists around the world including Dr. F.F (Russ) Knapp Jr from Oak Ridge National Laboratory, whose work made the ^{188}W/^{188}Re generator a reality and Dr. Jae Min Jeong, whose radiopharmaceutical expertise helped establish ^{188}Re radiolabeling in kit formulation [7]. Following this landmark study, it was unfortunate that the momentum in propagating ^{188}Re based therapies stalled, mostly due to the availability of other radionuclides such as ^{90}Y and ^{177}Lu for developing different products [3].

In this light, Dr. Ajit Padhy and the World Association of Radiopharmaceutical and Molecular Therapy (WARMTH) embarked on developing a^{188}Re therapy program in 2013 at Kovai Medical Center and Hospital (KMCH) in Coimbatore, South India. Following treatment of the first patient with inoperable HCC at KMCH, and under the inspiring leadership of Dr Ajit Shinto, a new enthusiasm for this radionuclide therapy was born. After 1 year of experience with intra-arterial ^{188}Re lipiodol therapy for inoperable HCC, their stunning data, demonstrating stable disease or objective response in 85% of patients, were presented at the 2014 World Federation of Nuclear Medicine and Biology Congress in Cancun, Mexico. At this moment, and as the president of WARMTH, I along with the other governing board members unanimously decided that WARMTH should actively support propagation of this therapeutic technique and a special task force for ^{188}Re based therapies was created under the chairmanship of Dr. Ajit Shinto.

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After 3 years of hard work we have come a long way and it is exciting to highlight some of our achievements. We now have a dedicated WARMTH $^{188}W/^{188}Re$ generator available at a subsidized cost and on a regular basis, a major achievement given the previous lack of commercial interest. The first dedicated World Rhenium Congress(WRC) has been hosted by KMCH in 2015 under Dr. Ajit Shinto in collaboration with WARMTH. This landmark congress was a resounding success with participation from over 35 countries and almost 250 delegates in attendance. Workshops on ^{188}Re dosimetry, $^{188}W/^{188}Re$ generator radiochemistry, radiopharmaceutical applications and quality control have led to six new departments initiating ^{188}Re based therapy programs, four from India and two from other Asian countries. It is has been most fulfilling to see the WARMTH ^{188}Re taskforce plans translated into real world treatments within such a short period of time.

Continuing in this spirit, this special issue of the International Journal of Nuclear Medicine and Research aims to inspire new developments as well as build on established applications of ^{188}Re based therapy in the nuclear medicine community. The broad range of topics presented in this issue and the possibility of integrating ^{188}Re into our growing number of radiopharmaceutical therapeutic options is particularly encouraging for the future of the field. With the potential for ^{188}Re based peptide receptor radionuclide therapy (PRRT) and prostate-specific membrane antigen radioligand therapy (PRLT) a new era in radionuclide therapy is within reach. Perhaps, as an ideal theranostic combination, the partnership of ^{188}Re and ^{99m}Tc is set for a revival!

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