Lutetium-177 Labeled Hydroxyapatite (HA) for the Treatment of Rheumatoid Arthritis: Kit Product Development

Radiochemistry and Isotope Group

Intra-articular administration of particulate formulations of β− emitting radionuclides of suitable decay properties is a treatment option for patients suffering from inflammatory joint disorders like rheumatoid arthritis (RA) to relieve pain and inflammation, the procedure being known as ‘radiation synovectomy’. BARC has developed and made available products for this purpose using different radionuclides. Among these, the use of $^{177}$Lu ($T_{1/2} = 6.65$ d, $E_{\beta_{\text{max}}} = 497$ keV, $E_{\gamma} = 113$ KeV (6.4%), 208 KeV (11%)) is attractive, especially for medium-size joints, owing to its β− decay energy as well as easy and cost-effective production using Dhruva reactor. In view of this, the Isotope Production & Applications Division (formerly Radiopharmaceuticals Division) has developed a ready-to-use kit containing hydroxyapatite particles (HA, 1-10 μm size, that had been used in the past for similar application with other radionuclides) for formulation of $^{177}$Lu-labeled HA at the hospital radiopharmacy for subsequent clinical use. Following in vitro radiochemical studies and pre-clinical evaluation in animal models done by IPAD-BARC, Kovai Medical Center & Hospital, Coimbatore performed the first clinical application of the product in RA patients. Their clinical study had been approved by the institutional ethics committee (Registration No ECR/112/INST/TN/2013) and all patients had provided written informed consent. Significant improvement was reported in ten patients with rheumatoid arthritis of knee joints treated with $333 ± 46$ MBq dose of $^{177}$Lu-HA. The BARC-developed kits would enable convenient one-step preparation of $^{177}$Lu-HA (400±30 MBq dose) of >99% radiochemical purity at hospital radiopharmacy for clinical use.

Treatment of rheumatoid arthritis using $^{177}$Lu-HA developed at BARC