



Traceability Boosts Cancer Therapy

Molecular radiotherapy (MRT) effectively targets cancer while minimising damage to healthy tissue. It relies on safely getting short-lived radioactive products directly to the tumour and monitoring up-take using complex patient imaging. The accuracy of these measurements depends on the calibration of instruments for measuring radioactivity, using a method that gives traceability to the SI. Reducing the existing calibration chain will increase administered drug accuracy and lead to optimised individual MRT patient therapies.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

For many years molecular radiotherapy, MRT, has been used for palliative cancer care, but it has great potential to become a potent first line cancer treatment. The therapy uses radioactive drugs to target specific tumours, for example radioactive yttrium-90 microspheres are used to treat liver cancers.

However, accurate activity measurements of administered short-lived radioactive drugs in the clinic are needed to make sure that the tumour receives just the right radioactive dose. Therefore, both the activity meters used to make these measurements and the cameras taking images to confirm therapy delivery require accurate calibration. The calibration of activity meters typically involves hospital nuclear medicine departments measuring highly radioactive solutions and then sending these to expert laboratories for a rigorous activity determination. This extended traceability chain is time-critical as the radioactivity of nuclear medicine drugs drops rapidly. A more direct calibration chain would remove the need to transport highly radioactive and short-lived materials large distances and also increase the accuracy of clinical measurements.

Solution

The EMRP project *Metrology for molecular radiotherapy (MetroMRT)* devised a method for determining the dose to tissue per administered MRT to a patient, as a chain of measurements traceable to the SI units of dose and activity. Using the principles of metrology it was possible to evaluate the contribution to the dose measurement of the uncertainty due to the activity measurement. This demonstrated the importance of reducing the uncertainty in activity measurements.

A portable scintillation counting system, based on a technique which counts light flashes generated as radioactive decay occurs in a scintillant solution, was developed to measure the activity of the therapeutic agents used in MRT. This method has the advantage that it self-calibrates and does not rely on any other reference standards or materials. The counting system, initially developed in the EMRP project *MetroFission*, was validated in *MetroMRT* and has now been used for the first time to directly measure the activity of Yttrium-90 outside of a calibration institute.

The new portable system opens up the possibility of hospital nuclear medicine departments being able to calibrate their clinical activity meters with direct traceability to the SI units on site.

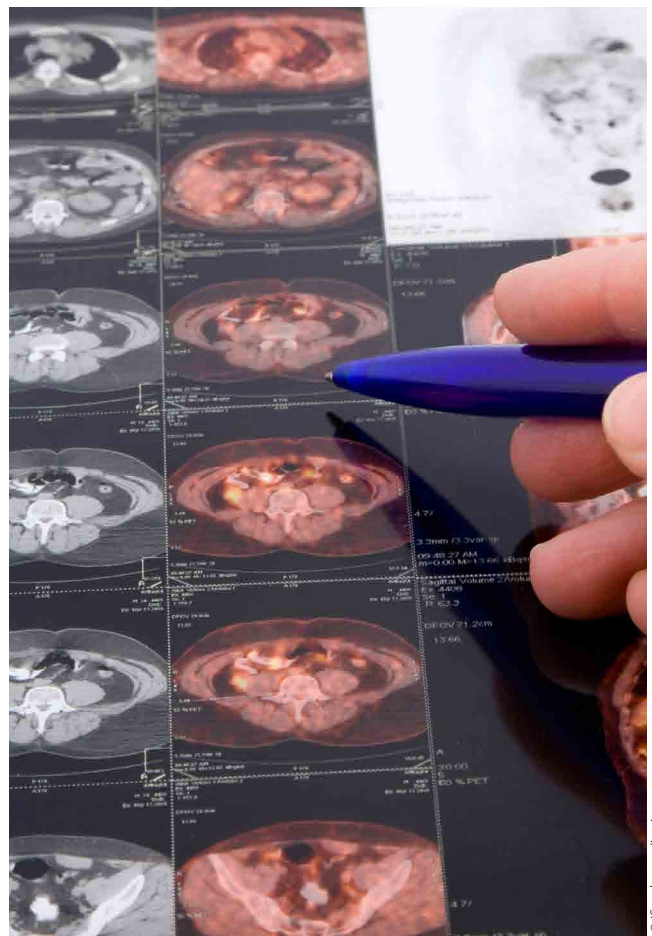
Impact

Italian cancer centres, Regina Elena National Cancer Institute and the Bambino Gesù Children's Hospital in Rome, have successfully used the project's portable system to calibrate their activity meters directly, by comparing measurements of sample activities of MRT drugs. Now these hospitals have more accurate calibrations for the instruments used to measure radioactive therapies before injection into patients and also for imaging cameras used to assess its delivery.

Sirtex, a company that markets Yttrium-90 microsphere technology for MRT, is keen to have medical institutions use the project's portable scintillation counting system and is actively supporting its widespread adoption across the EU. Direct hospital calibrations for instruments and cameras used to measure radioactive drugs and therapy delivery will increase accuracy of measurements of patient doses and open the way to greater effectiveness in personalised MRT cancer care.

Metrology for molecular radiotherapy

The EMRP project *Metrology for molecular radiotherapy* was the first European project to develop standard methods for measuring the absorbed dose received by patients undergoing molecular radiotherapy (MRT). This enables radiation doses to be better tailored to individual patients, increasing the effectiveness of treatment for conditions such as cancer and thyroid disease while minimising side effects. The project results will form a valuable basis for implementing individual dosimetry in MRT clinics across Europe and improving treatment outcomes.



EMRP

European Metrology Research Programme
► Programme of EURAMET



The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union

www.euramet.org/project-HLT11

Vere Smyth

NPL, UK

+44 20 8943 6223 | vere.smyth@npl.co.uk