

The Importance of Training, Accreditation, and Guidelines for the Practice of Theranostics: The Australian Perspective

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In nuclear medicine, theranostics is a burgeoning development that is rapidly being implemented worldwide. There is an increasing need to provide a multidisciplinary framework to the practice of theranostics, ensuring that patients receive this treatment safely and are secure in the knowledge that their health-care practitioners are adequately trained. Nuclear medicine experts in Australia have taken the initiative of producing a set of theranostic guidelines relevant to Australian medical practice. These guidelines encompass specialist qualifications, patient care, radiopharmaceutical production, radiation safety, and dosimetry. We propose adaptation of these guidelines by other countries, and we promote standards of practice leading to optimal clinical outcomes for patients receiving theranostic treatments.

Key Words: molecular imaging; general oncology; radionuclide therapy; guidelines; theranostics; training

J Nucl Med 2022; 63:819–822
DOI: 10.2967/jnumed.122.263996

Theranostics is the buzzword of the century in nuclear medicine, denoting cell targets with paired imaging and therapeutic radionuclides. Theranostic imaging is used to guide subsequent therapy by demonstrating that a cellular target is expressed at a sufficient concentration for a targeted radionuclide treatment to work. The concept embodies precision medicine targeting the right treatment for the right patient at the right time. Although most often utilized in oncology, it also has potential applications in neurology and cardiovascular disease.

Several landmark theranostic papers have been published in recent years (1–4). The success of these trials and subsequent implications for management of these radionuclide treatments in patients have driven increasing demand for this form of treatment, not just from the treating oncology specialists but from the patients themselves, especially in this digital age with patients connecting via social media. The other consequence of this success is increasing involvement of small to large pharmaceutical companies in theranostic research and development.

Although this treatment approach is being rolled out in both developed and developing countries around the world, there are few consensus statements on the overall safe practice of theranostics. There are individual best-practice statements and guidelines (5,6), and the International Atomic Energy Agency has developed a “Training Curriculum for Nuclear Medicine Physicians” document (7). This technical document states that there should be an understanding of the general principles of treatment using radiopharmaceuticals and unsealed radioactive sources, including the theranostic approach for personalized medicine. Unfortunately, it was not within the scope of that document to expand on the specifics required in order to be accredited for the practice of theranostics. The Nuclear Medicine Global Initiative on Theranostics, of the Society of Nuclear Medicine and Molecular Imaging, is currently working on a universal approach to the practice of theranostics.

In Australia, the peak body of nuclear medicine medical practitioners—the Australasian Association of Nuclear Medicine Specialists (AANMS)—has produced a position statement on the practice of theranostics in Australia (8). This statement was produced in conjunction with representatives from the multidisciplinary membership of the Australia and New Zealand Society of Nuclear Medicine, including medical physicists, radiopharmaceutical scientists, nurses, and nuclear medicine technologists. This position statement provides a consensus on recommendations regarding the care of patients receiving theranostic therapy and to support the provision of safe, high-quality, targeted care by qualified professionals. These

Received Feb. 8, 2022; revision accepted Mar. 22, 2022.
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Published online Apr. 7, 2022.

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recommendations include identifying the optimal workplace and facility requirements for the production and administration of a radiopharmaceutical, establishing specialist training requirements, and establishing patient workflow and multidisciplinary team requirements. The recommendations cover some essential prerequisites for the practice of theranostics, including the qualifications of a theranostic specialist; appropriate patient selection for theranostic treatment; and individualized treatment plans and departmental requirements, including radiopharmaceutical production and quality control, radiopharmaceutical administration, and discharge requirements.

This position statement outlines common concepts that need to be understood by theranostic specialists. A wide range of theranostic therapies is currently available, with more on the horizon. The most important components of theranostics that were considered in the development of these guidelines include acknowledging the differences and complexities involved in managing patients, developing a good understanding of the breadth of treatments available, and aiming for a strong multidisciplinary approach to patient management. There is also an inherent need to understand the patient's objectives with regard to treatment and to ensure that patient consultation is an essential component of determining optimal patient management.

SYNOPSIS OF AANMS POSITION STATEMENT

The Theranostic Specialist

In the AANMS position statement, a theranostic specialist is defined as a qualified nuclear medicine specialist trained in the practice of theranostics by the Committee for Joint College Training in Nuclear Medicine, which oversees nuclear medicine training in Australia, with representation from the Royal Australasian College of Physicians and the Royal Australian and New Zealand College of Radiologists. To obtain accreditation in theranostics, a qualified nuclear medicine specialist in Australia needs to meet specified accreditation and training requirements as outlined in this paper. PET and SPECT interpretation is fundamental to determining suitability for treatment, dosimetry, and response assessment for theranostic practice, and nuclear medicine provides this expertise. In Australia, nuclear medicine training includes a wide range of adult and pediatric imaging with radiopharmaceuticals; radionuclide therapy, including thyroid cancer; and radiation protection principles and legislative requirements for administering radiopharmaceuticals. The requirement for subaccreditation in theranostics within our specialty group recognizes the importance of advanced training and experience in this emerging area and the lead role of nuclear medicine in this field.

NOTEWORTHY

- The rapid expansion of theranostic services requires guidelines for safe practice.
- The practice of theranostics requires a multidisciplinary approach involving the referrer and service providers, including dosimetry and radiopharmacy.
- Medical practitioners providing theranostic services should be appropriately trained and credentialed.

The Patient

Clinical consultation is an essential step in the proper evaluation of a patient's suitability for radionuclide therapy, including a full clinical assessment of the patient's medical condition and evaluation of the appropriate molecular imaging studies for the theranostic agent to be given. Careful imaging assessment underpins the decision-making process regarding the appropriateness of radionuclide therapy for each patient. This imaging must also be performed in an appropriate time frame relevant to the condition being treated in order to minimize disease progression or transformation, which may impact treatment efficacy. Again, this imaging should be performed in a multidisciplinary setting that enables accurate and shared discussion of all imaging results and clinical aspects of patient care. If treatment is recommended, the patient must be told the practical aspects and logistics of treatment, including any potential side effects and complications, management of the side effects, and long-term complications. Any radiation protection issues relevant to the patient and family members must also be communicated. Once fully informed, the patient can decide whether to proceed with treatment, and written informed consent must be obtained.

After treatment, there should be a follow-up assessment with the treating theranostic specialist according to local institutional practice, with assessment of toxicities, imaging results, and pathology results, as needed, to determine whether the patient remains suitable for further cycles of radionuclide therapy and, if so, whether any dose modifications are required. There should be ongoing multidisciplinary involvement, with shared care between the referring oncology specialist and the theranostic specialists throughout treatment, to ensure optimal holistic disease management. This aspect is particularly important in patients with more aggressive disease and pain control requirements. Shared care can involve alternating visits between the oncology and theranostic specialists (such as at 3-wk intervals). A multidisciplinary team, also known as a tumor board, may also be of value, not only at treatment onset but at seminal stages of treatment (particularly at premature cessation and when any complications arise) and to consider or coordinate other therapies, if appropriate.

Radiopharmaceutical Production

Depending on the relevant local regulations, radiopharmaceuticals may be produced by a central radiopharmacy or a local hospital-based radiopharmaceutical laboratory. The AANMS guidelines cover the specific requirements, and in alignment with our local regulatory requirements in Australia, the radiopharmaceutical can be manufactured in a departmental radiopharmacy by a trained radiopharmaceutical scientist using appropriate standard operating procedures (SOP) under good laboratory practices adopted for continued process control and high-quality standards. When applicable, radiopharmaceuticals should be prepared according to regulatory and monograph guidelines. The entire manufacturing process should be documented on a batch record or worksheet, and staff training and compliance with this procedure should be recorded. Deviations from this procedure should be documented according to site protocols. A risk-based approach to process validation should be completed before radiopharmaceuticals are prepared for human use.

Equipment used in the manufacturing and quality control testing of radiopharmaceuticals should be certified at installation and then checked routinely to ensure reliability in operation. Ongoing maintenance-and-use logs for critical equipment are also recommended.

Radiopharmaceutical production in commercial radiopharmacies is performed under good-manufacturing-practice guidelines.

The final review of product quality remains the responsibility of the administering theranostic specialist.

Medical Radiation and Dosimetry

Good radiation safety practices both within the department and in the general population must be maintained according to local regulations. The development of SOPs would commonly involve a medical physicist and radiation safety officers. For outpatient treatments, the medical physicist's advice is used to decide when patients can be released from the treating facility to their home, another residence, or back to the hospital ward. Once released, patients need to be aware of the radiation protection guidelines to be followed and for what period these apply. This advice can be given by a theranostic medical specialist, a trained medical physicist, or a nuclear medicine technologist. Any departure from normal procedures, such as a spill or an extravasated injection, will require an objective assessment of the likely implications and expert knowledge of the procedures that should be undertaken to mitigate the effect on patients. The medical physicist also plays a critical role in assisting with dosimetry and individual dose planning, as required.

Sites should have specific guidelines for each radiotherapeutic administration, with site-specific medical, nursing, and technological protocols, as each group will often have important roles in supervising the patient before, during, and after treatment and may coordinate care arrangements. Nursing staff will also administer any required premedications for the specific radionuclide therapy and any necessary preparatory infusions (e.g., amino acids).

All departments should have SOP guidelines for delivery of therapeutic radiopharmaceuticals, to ensure absolute safety of the staff, patients, and general public.

All SOPs developed should be endorsed by both the medical physicist involved in the delivery of care at that site and the theranostic medical specialists directly responsible for care at the treatment facility. In Australia, a qualified nuclear medicine medical physics specialist accredited with the Australasian College of Physical Scientists and Engineers in Medicine must oversee this endorsement, either actively or through the use of an SOP.

TRAINING AND ACCREDITATION

All medical specialists seeking to establish proficiency in theranostics are required to achieve the following skills during their training program: understanding of the physiology and radiation physics used in theranostics, including understanding of the radiobiology of therapeutic nuclear medicine; patient selection (including molecular imaging assessment and correlation) and preparation; understanding of the standard-of-care therapies for different cancer subtypes; understanding of how theranostic treatments fit optimally with other cancer treatment options and when it is most appropriate for theranostics to be administered in each patient journey (the right treatment for the right patient at the right time) based on existing evidence; understanding of the indications, contraindications, and management of adverse events; and radiation protection of the patient, staff, and general public.

The AANMS document has provided some requirements for 2-level accreditation. These include a variety of live and case-based learnings, with a range of therapies and documentation for both prospective and retrospective training. In recognition of prior practice, a legacy provision category has been developed for current

nuclear medicine specialists who wish to apply for credentialing according to the level they have reached over the last 3 y—either general accreditation or advanced accreditation.

General Accreditation

Completion of the minimum additional training requirements or legacy provisions for specialists in nuclear medicine will qualify the applicant for general accreditation, allowing participation in providing theranostic services. These requirements are experience with more than 50 therapies by initial consultations or administrations within the last 3 y, participation in multidisciplinary discussion of more than 50 cases, and ongoing participation in relevant continuous professional development activities (e.g., conferences or courses).

Advanced Accreditation

Practitioners who have extensive experience may apply for advanced accreditation. Advanced accredited specialists will be allowed to provide training and are a requirement for site accreditation. Advanced accredited specialists must have clinical experience that encompasses more than 120 therapy initial consultations or administrations within the last 3 y, participation in multidisciplinary discussion of more than 100 cases, ongoing participation in relevant continuous professional development activities (e.g., conferences or courses), and participation in recognized research in the field.

The training site requirements are also outlined, but the minimum level includes the presence of an accredited theranostic specialist onsite during delivery of the therapy, and other necessary staff. There should be an updated protocol manual that describes general provisions for administration of radionuclide therapies and for each specific therapy offered, including the roles of medical, radiopharmaceutical scientist, physicist, nursing, and administrative staff and the protocols for radiopharmaceutical dispensing, labeling, and disposal (as required). Regular multidisciplinary team meetings that encompass all theranostic applications used at the site are also important.

THERANOSTIC COMMITTEE

The committee will aim to promote a collaborative and consistent model of theranostic training and service delivery, with a multidisciplinary representation from the Australia and New Zealand Society of Nuclear Medicine, the relevant colleges or stakeholders, and a patient representative. The committee's role is to formulate and review guidelines for training in theranostics, provide and review suitable training courses, advise on theranostic research initiatives, and advise the government on theranostics. Training courses in theranostics do not necessarily supplant experiential training, which is the most important aspect in the provision of theranostics.

CONCLUSION

Although theranostics has increasing importance in the future of nuclear medicine, there is a constant need to ensure that delivery is by the most qualified specialists in the field, which in Australia are the appropriately trained nuclear medicine specialists. The AANMS position statement is the first local foray into addressing this issue but can be adapted to the requirements of any jurisdiction across the world.

DISCLOSURE

No potential conflict of interest relevant to this article was reported.

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