Use of Medical Isotopes: Summary for Radiologists

The following is based on the Canadian Agency for Drugs and Technologies in Health (CADTH) report *Optimizing Health System Use of Medical Isotopes and Other Imaging Modalities.*

Technetium-99m (^{99m}Tc) is the radioisotope used in approximately 80% to 90% of nuclear medicine procedures and is integral for imaging various clinical indications. Molybdenum-99 (^{99}Mo), the precursor to ^{99m}Tc, is produced at major nuclear reactors globally. Due to their ages, the reactors are experiencing an increasing number of scheduled (for maintenance) and unscheduled shutdowns and, because of this, ^{99}Mo is subject to unplanned supply disruptions.

The use and allocation of ^{99m}Tc in facilities comes under pressure when supply disruptions occur, so how do you decide where ^{99m}Tc should be used in a facility with many diagnostic needs? How do you determine what the most suitable alternative to using ^{99m}Tc is, or if there even is one? How do you optimize the use of ^{99m}Tc in the health system, while still recognizing the variation in needs and available equipment in each facility and organization?

To address these questions, CADTH carefully reviewed the available research and assembled a national panel of experts to help provide some answers. In particular, CADTH:

- worked with the Medical Isotopes and Imaging Modalities Advisory Committee[*] (MIIMAC) to identify a list of common clinical uses of ^{99m}Tc.
- with the guidance of MIIMAC, identified which clinical uses of ^{99m}Tc had suitable diagnostic imaging alternatives, and identified those options.
- produced a prioritization list for the use of ^{99m}Tc, from a national perspective.

Key Findings for Radiologists:

- The optimal allocation of ^{99m}Tc in the event of a supply disruption requires the consideration of local context.
- Through the use of the CADTH web-based prioritization tool, the unique characteristics of a facility or organization can be considered in the production of a customized prioritization list.
- If there is no alternative for a particular clinical use, then that use would be, by default, a priority and should be excluded from the prioritization process. CADTH identified five clinical indications for which there was no reliable alternative to ^{99m}Tc-based imaging. You may have more at your institution — in particular, if certain imaging modalities are not available to you.
- By using the CADTH web-based tool, users are provided with an evidence-based method to consistently make informed resource allocation decisions.
- The national guidance final report contains an example of a prioritization list, which has been informed from a national perspective. For a context-specific prioritization list, the web-based tool should be used.
- The web-based tool provides users with the ability to inform emergency preparedness protocols, which can be called upon in the event of a supply disruption.
- By selecting multi-criteria decision analysis (MCDA), CADTH has provided users with a tool that was developed using explicit and transparent methodology.

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[*] *The Medical Isotopes and Imaging Modalities Advisory Committee (MIIMAC) consisted of representatives from health professions, institutions, regions, ministries of health, the public, and experts in scientific research and methodology. This committee was convened specifically to provide advice to CADTH on a project that led to a guidance document on the optimization of health system use of medical isotopes and other imaging modalities. MIIMAC provided guidance that considered the outputs and impact of CADTH work in meeting the needs of the Canadian health care system.*

- developed a web-based tool to allow users to generate customized priority lists guided by evidence and expert opinion, which are unique to the user's context.

A list of uses, which are included in the web tool as possible clinical uses of ^{99m}Tc, are provided in Table 1. *The order in which the clinical uses appear does not reflect priority.*

Table 1: Clinical Uses of ^{99m}Tc Included in Multi-Criteria Decision Analysis
Detection of ischemia
Assessment of prognosis post-myocardial infarction
Preoperative assessment prior to vascular, non-cardiac surgery
Implantable cardiac defibrillator decision-making
Assessment of drug-induced cardiotoxicity
Evaluation of renal function — post-transplant
Evaluation of renal function — suspected obstructive uropathy (in children and adults)
Evaluation of renal function — renovascular hypertension
Diagnosis of acute osteomyelitis (in children and adults)
Evaluation of painful prosthesis (loosening and infection)
Imaging for metastatic disease (breast, lung, and prostate cancer)
Diagnosis of avascular necrosis
Diagnosis of fracture (osteoporotic and stress)
Detection of lower gastrointestinal bleeding
Diagnosis of acute cholecystitis
Assessment of bile leak
Detection of pulmonary embolism
Identification of the sentinel lymph node in patients with breast cancer

Table 2: ^{99m}Tc Clinical Uses Excluded from the Multi-Criteria Decision Analysis Due to Lack of Reliable Imaging Alternatives
Evaluation of reflex sympathetic dystrophy
Diagnosis of Meckel's diverticulum in pediatric patients
Imaging suspected cases of brain death
Diagnosis of acute pyelonephritis in pediatric patients
Evaluation of the limping child (excluding suspected cases of abuse)

For complete reports and intervention tools on this topic, please visit www.cadth.ca.

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