Communication of radiation risk in nuclear medicine: Are we saying the right thing?

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ABSTRACT

The radiation risk arising from nuclear medicine investigations represents a small but manageable risk to patients and it needs to be effectively communicated to them. Frequently in the culture of “doctor knows best,” patients trust their doctors to do whatever is right and appropriate and leave it to them to worry about any attendant risks associated with any tests involving the use of radiation. The benefit to the patient of having a speedier diagnosis and a further guide to management may not be effectively communicated in a comprehensive, timely and professional manner. In this article, we address the issue of communication of radiation risk and benefits to patients and the basis for such information. While there are different ways of communicating radiation risk, we recognize that certain basic parameters are absolutely essential for patients to enable them to make an informed choice about undergoing a nuclear medicine investigation under the direction of a well-trained and qualified individual.

Keywords: Radiation risk, risk benefit analysis, communication of risk

INTRODUCTION

Every medical procedure performed on any person, whether a child or an adult, carries some risk of injury. The risk of injury may be small or large depending on the type of activity undertaken. In nuclear medicine, it is generally perceived that the radiation risk from routine nuclear medicine tests is very small, but finite. There are a number of ways by which this risk is communicated and this varies from place to place.1) Once the information that is deemed essential to be communicated to a patient is agreed, the next step is to identify the best person or groups of persons who can communicate this risk to patients. Legal precedents set by bodies such as the International Commission on Radiological Protection indicate that this risk is best identified by the referring clinician at the time of the decision to request the test, taking into account the demography, clinical presentation of the patient and any influence on patient management as a result of the test in question.2) On a more practical level, the patients are more likely to be informed of the radiation risk by means of a leaflet before the test and they are given an opportunity to discuss the risks and benefits of the test with the departmental staff. What is clear is that patients definitely do need to be informed of the risks prior to the procedure and they should be given an opportunity to discuss this matter in more detail with a trained individual.

ESTIMATION OF RADIATION RISK

It is well-accepted that the estimation of radiation risk is not an exact science and most estimations are based on complex modeling derived from analysis of survivors of the Hiroshima and Nagasaki atomic disasters.3) This can be compared to the odds of winning a lottery ticket, but the persons hope to get lucky and beat the odds. Similarly, most patients undergoing nuclear medicine procedure would like to believe that the odds of developing some complications as a result of a diagnostic test are more theoretical than individually applicable. It is when this expectation of a purely theoretical risk is proved correct in the individual case or is proved to be a gross underestimate, the patients and their doctors go back to their discussions held prior to the test and whether those were “correct” or not.

BENEFITS OF NUCLEAR MEDICINE TESTS

The benefits of nuclear medicine procedure are relatively easier handle by the nuclear medicine professional. Indeed, more
than 95% of articles published in peer reviewed journals are “biased” toward positive reporting, and very few journals accept and publish negative findings of diagnostic tests. However, most of these articles rely on comparison of tests rather than identifying true risks to patients. The ethical standard relies on ensuring a wide safety net to ensure that the research protocols are reasonably safe, and that the participants are informed. Very few standards exist that expect researchers to actually quantify the risks to individuals from participation in the research studies.

The risk versus benefit paradigm for radiation doses from investigations in nuclear medicine
While most decisions in medicine are made in the context of a detailed risk benefit analysis, the challenge is to communicate the risks and benefits of a particular procedure while adopting a neutral stance. It is for this reason that the risk to benefit analysis and the communication of this analysis is best performed by the referring physician and not by a nuclear medicine professional. When quizzed individually, let alone when challenged, most referring physicians will claim ignorance of the detailed risks of their patients undergoing nuclear medicine procedures. It is indeed up to the nuclear medicine professionals to educate their colleagues to an adequate level and for them to then communicate in an unbiased manner to patients.

Methods of communication of risk
Due to the complex nature of most nuclear medicine procedures, we rely on a combination of written and verbal information when we communicate risk. The language and tone of the information is crucial and this needs to be applicable in the local context and setting. The challenge is even more difficult when dealing with illiterate patients who may view doctors and other nuclear medicine professionals with immense respect and admiration, and hence feel that they cannot be challenged. The principle of consent to undergo a nuclear medicine procedure is based on a detailed understanding of the risks and benefits of the procedure in question.

Consent in nuclear medicine
While most nuclear medicine professionals seek written consent for therapeutic nuclear medicine procedures, majority departments do not need written consent for diagnostic procedures. In the past, it was possible that many physicians ignored issues with specifically consenting patients for investigations in nuclear medicine, as this was frequently considered an additional waste of time, resource and energy. Due to the strict legal interpretation of an “assault” on an individual in most countries, any nonconsented procedure such as a simple intravenous injection could be deemed as an assault on that individual. Consent could be given in writing or could be implied. It is generally accepted that if a patient attends a department and holds their arm out for an injection, there is implied consent to proceed. There should be clear local guidelines on what actually constitutes a consented procedure within the department. Documentation of consent, which may not necessarily be in a written format, is crucial and when challenged, the nuclear medicine professional should be able to clearly identify the steps involved in justification of the procedure and the consent itself. Doctors represent a caring profession and are deemed always to act in a patient’s best interests, however, due to the realization that doctors are as much part of society as any other professional, there are professional standards that are expected and these can be monitored and quantified, should this be required. Doctors need to keep their knowledge updated, maintain professional attitudes at all times and they may need to change their practice as per each individual setting and indeed for each patient. Doctors practicing nuclear medicine also need to adhere to the highest ethical standards in medicine.

Communication of benefit versus risk
The way to effective communication of risk lies in the knowledge that there is also a risk which arises when a condition is not diagnosed or treated because an investigation was not performed. For example, in a case of possible pulmonary embolism in a woman who is 28 weeks pregnant, there is a direct risk, which arises because of nondiagnosis of this condition, if an investigation such as a lung perfusion-ventilation study is not carried out. The referring physician then has two options and of course he may be wrong in following either option because in the absence of an appropriate nuclear medicine investigation, he has no better way of knowing what option is actually correct. If he were to treat the patient with therapeutic anticoagulation and if the patient did not actually have a pulmonary embolism, then the patient runs the risk of bleeding during and after the pregnancy. This presents a risk to the life of the mother and fetus, which is not quantifiable but nevertheless such a risk, albeit small, does exist. If the referring physician takes the option not to treat the patient and if the patient did have a pulmonary embolism then this also presents a risk to the life of the mother and the fetus. The quantification of the risk is dependent in this case on the size and burden of the pulmonary embolus and on the presence or absence of impending right heart failure. Hence in this situation, there appears to be a definite benefit to the patient in undertaking the Nuclear Medicine investigation because here the benefits of the test far outweigh the risks involved, and the risks are not just “radiation” related risks, but also “clinical” risks.

How different communities handle risk
Every community handles communication of radiation risk differently. The active geopolitical and economic situation at the current time dictates the tone of communication, but the gist of the matter remains the same. For instance, in a wider context of political instability or natural disasters such as floods or earthquakes, it may not be appropriate to quote cancer risks as the long-term survival from the current situation cannot be taken for granted. The communication varies between “just a little information” or “no information at all” to perhaps even “information overload.” It is the responsibility of the nuclear medicine professional to provide definitive guidance to the patient in a manner, which is easily understood and causes the least misunderstanding, prior to the procedure. There must also be an attempt to avoid technical jargon as the patient is unlikely to really understand what is being communicated. There is an
opportunity to review the patient’s own understanding of the risks involved and to update them accordingly if required.

**Perception of risk from “anything nuclear” and the art of reassurance**

It is important to understand when communicating the risk of radiation that unlike the physician, the patient may not gather information from accurate sources. Instead the patient may actually have his/her information from other sources which convey information varying from being only somewhat inaccurate in nature to being outright wrong. This problem arises partly because of patient factors such as patient background, education and age as well as the general misinformation about radiation, which may be perpetuated in popular and populist mass media.

Thus, some patients may have a wrong mental image of radiation, which may cause them quite a lot of anxiety. It depends on the long standing images and perception, which have been present in the mind of the patient. The seminal study by Slovic in 1987 showed that the general public may have fundamentally different ideas about risk arising from nuclear technology as opposed to experts in the field even when nuclear technology was compared to daily activities, which were quite risky in nature.7 While experts were of the opinion that activities arising from nuclear technology were quite safe, in the minds of quite a number of people from the lay population those very same activities were ranked number 1 in terms of risk. In these circumstances, it becomes incumbent on the Nuclear Medicine physician to reassure such patients.

**The role of the Radiological Safety Officer/Radiation Protection Advisor**

The Radiological Safety Officer or Radiation Protection Advisor is a technically qualified individual who can provide unbiased technical information on the measures that need to be taken to minimize radiation exposure to staff and patients. While this role could be performed by a clinically qualified individual, the primary role is one of reassurance to the hospital and to the public that all reasonable steps are being taken within the institution to reduce radiation exposure and hence reduce risk. In the most countries, this role has independent accountability and these individuals have to be involved in setting up protocols, assessment of equipments and also agreement on the level and type of patient information about radiation risk.

**Different concepts of “radiation exposure”**

Within Nuclear Medicine Departments in the United Kingdom, it has become standard practice to try and compare the amount of radiation conferred by a nuclear medicine test to a duration of time spent within a city, which enjoys a somewhat higher than normal background radiation dose from the atmosphere and other sources.8,9 Within the United Kingdom, the annual background radiation dose is 2.8 mSv. The annual background dose of radiation in Cornwall is higher than normal at approximately 7.5 mSv.10 A patient undergoing a lung scan using 200 MBq of Tc99-m-microaggregate albumin (Tc99-m-MAA) will be imparted a radiation dose of 2 mSv with a dose of 0.2 mSv ensuing from the ventilation if Krypton 81 m is used. If only a planar dose is being used for a lung perfusion-ventilation scan then the dose becomes approximately 1.2 mSv assuming that an injected activity of 100 MBq of Tc99-m-MAA is being used for the study. The standard method would be to tell the patient that the amount of radiation they would get from the procedure would be equivalent to spending approximately 5 months in Cornwall, assuming the higher dose of 2.2 mSv imparted by the higher injected activity. Such an approach ensures that the patient is given the appropriate amount of information while also making sure that the patient is not given undue cause for any alarm. To somebody who routinely undertakes many long distance flights every year, a different approach may be more suitable, which compares the radiation dose from a test to the cosmic radiation, which ensues from those long distance flights.

In the research setting, the level of risk is considered “trivial” if the effective dose is <0.1 mSv; “minor” if the effective dose is between 0.1 and 1 mSv; “intermediate” if the effective dose is between 1 and 10 mSv; and “moderate” if the effective dose is >10 mSv.9

Some institutes adopt a completely different approach which may be compatible with the increased risk of litigation. For example, a representative information sheet for research when a dose of 15 mSv is expected could say: “Your scan in nuclear medicine involves exposure to radiation. Although it can vary from person to person, your whole body radiation exposure during each scan will be about 15 mSv. This is about 5 times the average annual radiation exposure a person in the United States receives from natural background radiation. Although no harmful effects are expected, your long-term risks of harm from this degree of radiation exposure might be as high as 1 in 1000. Harmful effects could include the development of cancer and genetic changes.”

This is obviously an area for huge variation of practice across countries and within countries as well. Each department has to adopt and adapt the appropriate level of information for patient consumption and the means (verbal, written, web-based) of information they would like to communicate, keeping in mind the legal framework of their country and institution.

**Role for national specialist nuclear medicine societies**

The national specialist societies have a key role in ensuring the safe and effective practice of nuclear medicine for both patients and staff. Their roles may include the following (not an exhaustive list):

- Ensure the practice of minimum standards for consent for nuclear medicine procedures. This may be dictated by legal concepts on consent to undergo medical procedures
- Encourage local dialogue between nuclear medicine professionals and referring physicians to enable clear local guidelines on patient information
• Encourage nuclear medicine professionals to undertake local training on radiation risk for referring physicians, or indeed set up national or regional workshops on communication of radiation risk
• Encourage the sharing of good practice on patient information by holding national competitions where departments can highlight their best practice and share this best practice under national auspices.

SUMMARY

In summary, when obtaining consent for nuclear medicine investigations it is important that the radiation risk is communicated in a precise manner, which is devoid of technical jargon so that the patient understands what is being said. Information should be provided on the radiation risk, the risk of not having the procedure and the benefit of a speedier diagnosis. While individual nuclear medicine professionals retain local responsibility and accountability, there is a clear role for specialist societies to assist in the safe and efficient practice of nuclear medicine.

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