# Medical radiation and the risk of cancer

*Although the risk from medical radiation is small, we should not become complacent*

IONISING RADIATION is one of the most extensively researched agents in our society. Indeed, more is known about its effects than the effects of most other things in our environment. High doses are known to be harmful, with the main long-term adverse effect being cancer induction. The best evidence for this comes from survivors of the atomic bomb explosions in Japan, where models have been developed relating increased cancer induction to the dose of radiation received. Although the magnitude of the effect is small, the link is well established.

Diagnostic x-rays are the largest man-made source of exposure of the general population to radiation. Even if the risk from radiation to an individual is very small, exposure of a large number of people over time could translate into a considerable number of cancer cases. A recent report in *The Lancet* attempts to quantify the risk of cancer induction from diagnostic x-ray procedures, averaged over the population.[1] From surveys of medical radiation use in a number of countries, the authors obtained information on the average annual frequency of various x-ray procedures and estimated the doses to various organs from those procedures. They then applied a model of radiation-induced cancer cumulative risk to the doses received by the various organs to derive an estimate of the attributable risk of developing cancer. Their analysis suggests that in Australia about 431 cancers per year (1.3% of all cancers) could be attributable to diagnostic x-rays. The corresponding percentages for 14 other countries considered ranged from 0.6% in the United Kingdom and Poland to 3.2% in Japan.

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Their study does not provide any new evidence that radiation from diagnostic medical procedures causes cancer. Rather, the researchers rigorously applied an existing model to medical diagnostic radiation exposure of the population to derive the best estimate to date of the magnitude of the risk of cancer induction. They acknowledge that there is considerable uncertainty attached to this estimate and that a number of assumptions had to be made in performing the analysis. There is uncertainty about the number and types of radiological procedures, the derivation from these data of doses to individual organs, and the applicability of the cancer induction model at the low doses used in diagnostic radiology.

Nevertheless, it is probable that medical radiation procedures do lead to a small increase in cancer incidence in the population. The lowest dose of x-radiation for which there is epidemiological evidence of increased cancer risk is 10–50 mSv for an acute whole-body exposure.[2] Some of the higher-dose diagnostic radiological procedures such as computed tomography (CT) produce effective doses at the lower end of this range.[3] At lower radiation dose levels, in the absence of epidemiological evidence, there is some uncertainty as to whether there is any effect. However, a linear relationship between risk and dose with no threshold is commonly accepted and is supported by some laboratory data.[2] Radiation protection agencies have adopted this linear-no-threshold hypothesis in their approach to risk management.[4]

The total population dose of radiation from medical diagnostic procedures is increasing worldwide, mainly due to the increase in CT scanning. CT entails the use of higher radiation doses than other common radiological procedures.[3] In Australia, Medicare data indicate that CT use has increased 140% over the decade 1992–2002. The reason for the increased use of CT is that it is now able to provide much better and more valuable clinical information, and to do so more easily, than in the past. As the technology has improved, the image quality has improved and scanning times have been reduced to just a few seconds. CT can now image fine detail, even in mobile organs, and hence the indications for its use have expanded.

It is easy to overlook the possible side effects of radiation, particularly if the risk is very low and the effect may not become apparent for years. Cancer may not develop until 20 to 30 years after radiation exposure, and so the group most at risk are people with a long life expectancy. Children are also more susceptible to the carcinogenic effects of radiation than adults.

When people are exposed to radiation, its use must be justified by ensuring that it does more good than harm. If radiological investigations are done for a specific clinical problem, the potential benefit significantly outweighs the very small risk. However, if there is no valid clinical reason for a procedure, the risk is still present for no tangible benefit. One area in which risk is considered to outweigh benefit is whole-body CT screening of healthy asymptomatic people.

The Royal Australian and New Zealand College of Radiologists has produced imaging guidelines on the appropriate use of diagnostic radiological procedures.[5] The Australian Radiation Protection and Nuclear Safety Agency is in the process of drafting guidelines on radiation safety in medicine.[6] Modern radiological equipment has the potential to reduce the radiation dose compared with older equipment. Radiologists also need to optimise their procedures to obtain the required diagnostic information using the lowest radiation dose.[7] The *Lancet* article serves as a reminder that the potential dangers of radiation need to be respected.

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