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Editorial

Too much of a good thing?

A recent publication of the National Council on Radiation Protection and Measurements (NCRP) provides information on the amount and sources of ionising radiation to which the US general public has been exposed, as of 2006. NCRP Report No. 160, entitled *Ionizing Radiation Exposure of the Population of the United States*, is an update of the similarly titled NCRP Report No. 93 issued in 1987. The present report contains two significant findings that have important implications for radiation protection dosimetry. First, there has been a 7-fold increase in the amount of ionising radiation to which the public has been exposed from medical procedures since the 1980s. And second, the fraction of total population exposure due to medical procedures is now the largest slice of the pie-chart representing all exposure categories in terms of the percentage of collective effective dose and effective dose per individual. Other sources of population exposure have remained relatively constant during the same time period. The large increase in medical exposure is attributed to the increase in the use of imaging procedures that utilise ionising radiation. Two types of medical imaging, computed tomography (CT) and cardiac nuclear medicine examinations, appear to contribute most to the increase.

The report concludes that the effective dose per individual, denoted by the newly created symbol E_{US}, for medical exposure in the USA in 2006 was 3 mSv. Additional information for other countries will be available in the latest UNSCEAR report, but it is safe to say that similar increases in effective dose per individual will occur in other countries. It has been noted that significant differences among countries are found in exposures of the population to medical radiation[1]. In the past, those differences were large and it is likely the same situation will be found today.

The number and types of radiation-based diagnostic procedures are likely to continue increasing. For example, a trauma patient admitted to an emergency room in a modern hospital might undergo multiple CT scans. In fact, CT will probably be used during follow-on examinations of that same patient. If the patient is a child, there may be an additional concern regarding the possible long-term effects of even low levels of radiation. In the USA, an effort that has been initiated by the Society for Pediatric Radiology and joined by several other organisations involved in medical imaging is entitled the Image Gently® campaign. This alliance is developing methods for lowering the dose used in the imaging of children and it is establishing links to medical organisations in other countries. Information can be found on their website[2].

Although there are ethical and legal controls on the use of ionising radiation in medicine, it is clear that some practitioners could be motivated to overuse a procedure involving ionising radiation because it will bring additional income. On the other hand, there is also a pressure not to underuse radiological imaging when there is a possibility for things to go wrong. There is a need to document and justify medical procedures. Physicians are aware of the possibility of legal actions resulting from their treatments and they may need to defend their actions in court. Radiographic images can help in such situations. It is clear that there will be continuing use of radiation-based diagnostic procedures, as long as the benefits outweigh the risks.

A few questions could be posed. Is there a serious problem regarding the increase in dose per individual due to medical radiation? It would be desirable to have a situation where the dose per individual is static or even decreasing with time. But, it should be noted that a large number of people may never receive any significant quantity of medical radiation, while some sub-populations such as the elderly and infirmed may receive more dose from medical sources. The values reported are averages over the entire population and the effect of statistical analysis needs to be considered. Another question is whether the principles of the International Commission on Radiological Protection are universally followed in medical practice. The use of ionising radiation in medicine, as in any other field, should be justified

and should provide a benefit to the recipient with a minimum of risk. One might also ask if there are international standards that would encourage uniformity in medical radiation exposure among countries. Such standards should certainly not specify particular quantities of radiation that could be used in medical procedures, but it might be possible to provide guidance on the measurement and recording of dose in those procedures.

There is no question that the deciding factor in the use of CT or cardiac imaging procedures is medical necessity. During a critical care procedure or emergency, a significant amount of ionising radiation may be being delivered to a patient, but if life is at stake there should be no argument about the decision to proceed. On the other hand, a diagnostic procedure involving a non-critical examination of a patient should make use of an appropriate level of ionising radiation. These considerations will surely be taken into account by the vast majority of physicians. As radiation-based diagnostic procedures become more complex and are more frequently employed, as is likely, it will also be incumbent upon physicians to acquire more knowledge and training in this complex area. Radiation protection professionals can help.

REFERENCES

1. Regulla, D. F. and Eder, H. *Patient exposure in medical X-ray imaging in Europe.* Radiat. Prot. Dosimetry **114**, 11–25 (2005).
2. http://www.pedrad.org/associations/5364/ig/ (last accessed 1 April 2009).

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