An Overview of Clinical Radiation and Patient Safety

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Radiation exposure from medical imaging is a growing patient safety issue. The increasing use of diagnostic studies that produce ionizing radiation and recent reports related to the potential human consequences of cumulative radiation exposure have contributed to this concern.

Multiple environmental sources of radiation exist, including sunshine, cellular phones, radar, microwaves, electrical power lines, nuclear power plant materials and medical uses (both diagnostic and therapeutic). Some types of radiation are known to be capable of breaking chemical bonds. Due to the displacement of electrons and creation of charged atoms or molecules, this energy is referred to as *ionizing* radiation.

Radiation dose is a complex concept and somewhat difficult to measure and will only be briefly addressed here. *Exposure* is a basic measurement of radiation emitted from a source. The *effective dose* that is then received by the human body depends on many factors, including distance from the source, time of exposure, presence of shielding, amount of patient exposed and the nature of the exposed tissues (overall body size, amount of fat, the location, composition and size of organs, etc.). Thus, there can be a significant variation in absorption and potential biological interaction because of differences among patients, their clinical situations and the imaging sources. Estimates of effective radiation doses have been developed with the aid of certain conversion and weighting factors.

Beyond a certain threshold of radiation exposure, severe non-malignant damage to various tissues and organs and even death can occur. These effects only follow high radiation doses, as were seen following the detonation of the atomic bombs in 1945 and subsequent severe nuclear power plant accidents.

The health effects of medical imaging are different, where the concern is the potential for incurring cancer and hereditary anomalies. These results can occur even at relatively low levels of radiation exposure. Dissenting opinions notwithstanding, the scientific evidence suggests a linear relationship between radiation dose and cancer outcomes. Thus, there is no "threshold" and *any* level of radiation exposure leads to an increase in cancer risk. Moreover, it is believed that multiple exposures are additive in their risks, though it is difficult to formulate an exact relationship.

Why is radiation an issue now? In recent years there has been a decrease in the utilization of conventional radiography and fluoroscopic procedures. Meanwhile, high dose computed tomography (CT) and nuclear medicine studies have increased significantly. The highest levels of radiation exposure in the most common diagnostic tests are generated by CT scans.

Though they now account for only a very small portion of overall cancer incidence, the adverse effects of radiation received during medical care are not insignificant. Given the recent utilization trends, these consequences may well expand in future years.

For more information on radiation safety, and how NIA is addressing the issue, visit www.NIAhealthcare.com or call 1-877-NIA-9762.

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