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Exposure to Radiation through Medical Usage

Medical exposures to radiation have been in use since 1895 when William Roentgen began taking X-rays of his wife's hand. The discovery that Radium could kill cancerous cells in the 1920s further expanded the use of radiation in the healing arts. The amount and type of exposure due to medical application varies by the type of test or treatment needed. The unit of measure for comparing the amount of radiation is the Radiation Absorbed Dose (rad). In order to understand the range of exposures, it is best to compare these exposures to background radiation.

Background radiation is the natural background radiation that has been with us forever. This is the radiation that normally comes from cosmic rays, the sun, and the radioactive material in the soil under our feet. The food we eat even naturally contains radioactive material that has been on Earth since it was formed. Variations in this normal exposure are not detrimental to human health. The normal background radiation level in Pennsylvania is about 0.3 rad per year. Certain areas in the world have much higher background radiation levels, some even up to 15 rad per year. Natural radioactive material has always been in our food and our bones and could not be removed. Our actions can change the amount of background radiation we receive. For example if you flew from New York to Los Angeles you would receive about 0.02 rad per trip.

Radiation exposures from diagnostic medical examinations are generally low and are almost always justified by the benefits of accurate diagnosis of possible disease conditions. The exposures are usually comparable to those that we receive routinely from the natural radiation all around us, and the benefits of the medical exams are of course very significant. There is no direct evidence of radiation causing harm at the exposure levels encountered with these tests. Examples of these exposures are Chest x-ray \approx 0.006 rad, Spine x-ray \approx 0.070 rad, Lumber spine series \approx 0.180 rad, CT head and chest \approx 1 rad, and Coronary angiogram \approx 1.5 rad.

Exposures from nuclear medicine diagnostic tests, in which radioactive material is injected or inhaled, are typically five to ten times higher than typical exposures from x-ray machines. They provide information that is impossible from x-rays such as how blood is flowing or how bones or tumors are growing. Examples of these exposures are Bone scan \approx 0.5 rad, Brain scan \approx 0.7 rad, Heart test \approx 1.7 rad, Tumor localization studies \approx 1.2 rad. Patients who receive these kinds of tests are radioactive for a few days to a few weeks after the material is administered.

Therapeutic uses of radiation involve **significantly** higher exposures and physicians will consider the risks of the treatment against the potential benefits. In radiation therapy, these much higher doses are given with the intent of destroying cancer tissues. The trick is to give enough dose to kill all cancer cells without destroying too many healthy tissues. It is not uncommon for therapy patients to have skin burns as a by-product of external radiation therapy. If the radiation therapy were delivered to the whole body rather than just the cancer area, the patient could not possibly survive. Exposures to parts of the body of 5,000 rad are not uncommon.

Special attention is paid to pregnant and breast-feeding patients. The developing embryo or fetus is particularly sensitive to radiation. If an examination that involves radiation exposure can be postponed or replaced with another study, this is often desirable. If the study is needed, precautions to eliminate or reduce the dose to the embryo/fetus are followed. Breast-feeding patients are of concern in nuclear medicine studies (diagnostic or therapeutic), because the compounds could pass from the mother to the infant. However, for diagnostic exposures, if the fetus is not in the radiation field, there is no risk to the fetus. Always notify the technician if you think you may be pregnant.

Magnetic Resonance Imaging (MRI) involves very intense magnetic fields, but no ionizing radiation. There are no known biological hazards to humans from being exposed to magnetic fields of the strength used in medical imaging today. There is no radiation exposure from this type of medical test.

Questions about your radiation exposure should be referred to your physician.

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