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The Myth of the "One Right Answer": Diagnostic X-Ray Risks?

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A paper in the December 2005 issue of the *Journal of the Canadian Chiropractic Association* by Oakley PA et al. questions the health risks of diagnostic plain film x-rays by reviewing the literature on low level radiation exposure and the "linear no-threshold" hypothesis. There is no question that there are significant risks from high dose ionizing radiation. Is there a difference between high dose radiation, such as from nuclear weapons detonations and major Chernobyl-type radiation leaks from nuclear power plants, and from low level radiation as one receives from diagnostic x-rays or background radiation? Is there a linear dosage relationship between high level and low level radiation? Is there no safe level of dosage? Dr. Gonstead stated that diagnostic x-rays can actually be beneficial to a person's health. He contended that taking a set of x-rays tended to lower high blood pressure.

In their introduction, the Oakley, et al state that there is a significant lack of scientific evidence for health risks associated with low doses of ionizing radiation as used in radiography. "Linear No-Threshold Hypothesis" (LNTH), when applied to ionizing radiation, has been used to estimate the risks of low doses of radiation by extrapolating data, via a linear model, from the risks associated with the high doses from the atomic bomb attacks on Japan in World War II. LNTH was developed in the absence of study data of the actual risks associated with low dose radiation when determining the risk of varying exposure to known carcinogens. (Oakley 2005) Many have used LNTH in assessing risk from diagnostic x-rays, of whom appears to be the well-known researcher, J. W. Gofman (Fickel 1986, Gofman 1999). A review by Kant, et al. in 2003 made the following statement: "'...whole body exposure to low-level ionizing radiation (LLIR) decreases overall cancer incidence (the most important long-term somatic effect of radiation exposure).'" Furthermore, Kant et al. made the statement that after reviewing the literature: "'the substantially acceptable conclusion (is) that whole body exposure to LLIR reduces cancer mortality rates when compared with control populations in both experimental animals and humans.'" (Oakley 2005) Pollycove states that studies of populations exposed to high natural background radiation have increased longevity and decreased cancer deaths and that in statistically significant controlled epidemiologic studies, they have demonstrated that exposure to low or intermediate levels of radiation are associated with "positive health effects." (Pollycove 1998) Pollycove also writes that the linear non-threshold hypothesis is not supported by statistically significant data found in human low dose radiation studies.

(Pollycove 1998) Some authors have begun advocating the abandonment of the LNTH for long level ionizing radiation and have even stated that cancer risk from diagnostic radiography may be much lower than estimate and may even be zero. (Oakley 2005)

A study of British radiologists between 1897 to 1979 did not show an increased mortality from cancer compared to a control group of non-radiologist MDs – the death rate from cancer specifically for those before 1920 was 75% greater than controls, but the death rate of the same pre-1920 group from noncancer diseases was 14% lower. After 1920, the death rate of British radiologists from cancer was much less than for controls. Furthermore, overall compared to the controls, the British radiologist had a lower standardized mortality rate compared to the control from cancer (29%), all causes (32%), and from non-cancer causes (36%). (Cameron 2003, Oakley 2005)

Natural background radiation is a low dose radiation source of concern to many. A study by Jagger for the U.S. Atomic Energy Commission found that states with the highest background radiation – Colorado, Idaho, and New Mexico – had levels 3.2 times greater than Alabama, Lousiana, and Mississippi, but the average cancer death rate in the 3 Gulf Coast states studied was 1.26 times greater than the aforementioned Rocky Mountain states. Other studies on radon, such as a Japanese study comparing a radium-containing spa vs other areas, had similar findings. In this country, there is a concern for houses with high radon levels. They found that houses with higher radon levels had lower levels of radon-induced lung cancer than those with lower radon levels. They also found that the smoking-caused cancer rates were lower as well.

A study of 28.000 nuclear shipyard workers with the highest cumulative doses had a death rate from all causes that was 24% and 16 standard deviations lower than a control group of 32,000 job-matched non-nuclear shipyard workers. (Cameron 2003, Oakley 2005) Other studies of nuclear industry workers had similar findngs. (Luckey 1991)

Hormesis

The hormesis thesis states that “low and high doses produce opposite results.” This is in contrast to the linear, no-threshold models which state that there is no level of radiation that might not be harmful. Animal and bacteria studies have found that high doses of x-rays were fatal, but low doses stimulated growth rates. (Luckey 1991)

How does hormesis explain what low level radiation dose does to an organism and the dramatic difference between high lethal doses and low level doses? From hormetic studies, research has found that lethal doses of radiation devastates the immune system and causes rampant infection as seen in radiation sickness. On the other hand, low level doses appears to cause stimulation of the immune system and statistically reduces the amount of infection and the incidence and mortality from cancer. Researchers

have found that whole body low dose radiation increased the number of circulating lymphocytes. (Luckey 1991) Cell culture studies have found that low doses of ionizing radiation produces less mutations and stimulates mitosis, lymphocyte repair processes, and DNA and RNA synthesis. the low doses suppresses the suppressor T cells and helper and functioning T cells function more efficiently. (Luckey 1991)

Fetal Exposure

Fetal exposure to ionizing radiation is controversial. Ursprung et al has recently written on the topic, although here again, the LNTH is used. (Ursprung 2006) It is best to avoid x-raying a pregnant woman, unless absolutely necessary.

Mutagens & DNA Repair

Pollycove writes that limitations in the accuracy of DNA replication and repair for every class of gene lead to up to 400,000 mutations/day in each individual. A rare one mutation by low linear energy transfer radiation won't have a significant impact if there is an intact, active DNA damage control biosystem – Dr. Ronald Pero from the Swedish University of Lund, who spoke at Renaissance Seminars in the 1980s, had some preliminary findings that seemed to indicate that those under chiropractic subluxation care had an improved DNA repair system, if I understand his findings correctly. The DNA damage control biosystem is decreased by high radiation dosage but appears to adaptatively respond by increasing activity in the presence of low dose radiation. (Pollycove 1998)

Is there a threshold between high dose radiation that is harmful to living beings and low level doses that appear to have beneficial properties? Unfortunately, the answer is unknown.

Taking Chiropractic X-Rays

For those who do take x-rays when required for analyzing patients and for those who are considering follow-up or post-x-rays, the Oakley et al state that according to research studies, the health risk of the use of diagnostic radiography in chiropractic, there is essentially no scientifically demonstrable risk to the given patient. In addition, follow-up or post-radiographs to monitor the response to treatment as is often done in some techniques, appear to provide negligible risk. (Oakley 2005) Should you reduce x-ray exposure when taking x-rays? It's just sensible practice. A recent study found that the radiation dose from a full spine x-ray series is more-or-less equivalent to 3 weeks to 4 months of natural background radiation. (Cracknell 2006) One should always use collimation which reduces dose by a factor up to 3 (Gofman 1999) and also reduces scatter-secondary radiation which improves the image, shielding where appropriate (gonadal shielding reduces dosage to the gonads by a factor of 2 to 10 (Gofman 1999)), general filtration of the primary beam with rare earth filters to filter out specific rays reduces dosage by a factor of 2 to 4 (Gofman), filtration of the primary beam to compensate for body density differences (unfortunately, this filtration does cause scatter and secondary radiation that may impair image quality), low exposure technique (e.g., high

mA/short exposure time/high kV improves tube life and reduces the potential for patient movement), and a matched high speed screen/high speed film combination which reduces dosage by a factor of 2 to 4 (Gofman). Many Gonstead chiropractors who take full spine x-rays are vigilant and use leaded glasses to protect the eyes and pituitary gland, shielding for the gonads and other sensitive tissues, high speed rare earth screens and film, filtration, and also use a long focal-object distance (focal film distance of 72" to 84" for full spine x-rays). As far as split screens and gradient screens, those are frowned on by radiological experts as attenuating the primary beam before it reaches the patient is preferred. They do produce better images because of less scatter and secondary radiation. For all of the technical difficulties involved in producing 14" x 36" standing, full spine radiographs, you can produce diagnostic-quality films in most patients.

It is your choice on which experts to agee with, but, in any case, beware of the myth of the "one right answer."

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