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X-Ray Hesitancy: Potential Concerns

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It is written in the abstract by Drs. Oakley and Harrison: "Medical X-rays present a small, insignificant addition to background radiation."[1] The estimated global average exposure from natural radiation sources is 2.4 mSv. The U.S. annual individual effective dose from diagnostic and interventional medical procedures was estimated to have been 2.9 mSv in 2006 and 2.3 mSv in 2016.[2] A carcinogenic effect has never been proven for the dose levels associated with diagnostic X-rays. Moreover, there is evidence in favor of radiation hormesis.[3,4] However, exposures may occur unpredictably. A cumulative dose being equal, acute exposures tend to be more effective than fractionated ones. The concept of DDREF is used for the adjustment of risk estimates. In the literature, cumulative effects of low-dose exposures protracted over many years are discussed. Certainly, the topic is controversial while the epidemiological research is associated with known and unknown bias.[5] Carcinogenic risks can be reliably assessed in large-scale animal experiments.

Some aspects of the Chernobyl accident are elucidated incompletely.[1] Even conservative appraisals do not exclude the possibility of radiogenic thyroid cancer after Chernobyl.[5] The statement "Regarding the Chernobyl accident, it must also be noted that . . . doses to the thyroid were 3 to 4 orders of magnitude greater than to other body organs"[1] is given with the reference.[6] It is written in the cited article: "The thyroid has a unique ability to concentrate and bind radioactive iodine, so that it receives a dose 500-1000 times higher than the rest of the body,"[6] which is not the same. According to the UNSCEAR, "as far as whole body doses are concerned, the 6 million residents of the areas of the former Soviet Union deemed contaminated received average effective doses for the period 1986-2005 of about 9 mSv."[7] For the same population "the average thyroid dose was about 100 mGy."[7]

The following statement is written without references: "Thus, repeated medical imaging, as long as it is in the low-dose range (<100-200 mGy), will not result in an actual accumulation of radiation-induced DNA damage as long as the repeat imaging is done after a lag period (i.e. 24-hour)."[1] In this way, up to $200 \times 365 = 73{,}000$ mGy can be accumulated in a year. Indeed, mutations can be repaired, but they can also accumulate. Furthermore, the supposition that "children are not more susceptible to radiation effects"[1] is questionable as the cells undergoing mitosis and hence growing tissues are supposed to be more susceptible to mutagenic stimuli. This is a topic for a separate review. Finally, ionizing radiation may act synergistically with some other carcinogens.

Considering the above, the concept of hormesis should be applied with caution in the clinical decision-making because hormetic stimuli may act without threshold on pre-damaged cells and atrophic tissues, in decompensated disease or old age. In conclusion, X-rays should be administered according to generally accepted clinical indications. In Russia, there is a tendency to enhance the number of self-paying patients undergoing CT. As a result, expensive examinations accompanied by X-ray exposures are sometimes performed without sufficient indications.[8]

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