Subjecting Radiologic Imaging to the Linear No-Threshold Hypothesis: 
A Non Sequitur of Non-Trivial Proportion

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BACKGROUND FROM DAN MURPHY:

A non sequitur is Latin for “it does not follow.” It means “an invalid argument,” or a conclusion that is “fallacious.”

The scientific unit of measurement for radiation dose, commonly referred to as effective dose, is the millisievert (mSv).

A millisievert (mSv) is defined as “the average accumulated background radiation dose to an individual for 1 year, exclusive of radon, in the United States.”

A milligray (mGy) is the unit of absorbed dose of radiation.

Conversion of mSv to mGy is not easily done, but an example is that a head CT is about 44 mGy or about 1-2 mSv. (an average CT is about 10 mGy)

KEY POINTS FROM THIS ARTICLE:

1) “Radiologic imaging is claimed to carry an iatrogenic risk of cancer, based on an uninformed commitment to the 70-y-old linear no-threshold hypothesis (LNTH).”

2) The linear no-threshold hypothesis (LNTH) has been applied to low-dose ionizing radiation for more than 70 y but lacks a valid scientific foundation. Yet, “this hypothesis is the orthodox foundation of radiation protection science, in turn forming the basis of regulations and public policy.”

3) “Credible evidence of imaging-related low-dose carcinogenic risk is nonexistent; it is a hypothetical risk derived from the demonstrably false LNTH.”

4) “On the contrary, low-dose radiation does not cause, but more likely helps prevent, cancer.” [Interesting]

5) “The LNTH and its offspring, ALARA (as low as reasonably achievable), are fatally flawed, focusing only on molecular damage while ignoring protective, organismal biologic responses.”
6) The as low as reasonably achievable (ALARA) “is a radiophobia-centered, not scientific, approach.”

7) “The LNTH is an invalidated hypothesis, and its use, in the form of ALARA dosing, is responsible for misguided concerns promoting radiophobia, leading to actual risks far greater than the hypothetical carcinogenic risk purportedly avoided.”

8) “The low-dose radiation of medical imaging has no documented pathway to harm.”

9) The LNTH claims that all acute ionizing radiation exposure down to zero is harmful proportionally to dose and that it yields cumulative harm throughout life, regardless of how low the dose rate. This is “demonstrably false.”

10) Humans are “bathed in low-dose radiation from land, sky, and our own bodies. Today’s average annual natural background exposure ranges from 1 to 260 mSv in some places on the planet. No associated adverse health effects have been documented anywhere.” “Typical CT and combined whole-body 18F-FDG PET/CT scan doses delivered acutely are 10 and 14 mSv, respectively.”

11) Earth’s life forms have developed adaptive, biologic repair and/or removal responses to radiation damage. “The primary LNTH fallacy is it excludes this evolutionary biology, ignoring the body’s differing responses to high versus low radiation doses.”

12) Low doses of radiation stimulate protective responses; high doses overwhelm and inhibit such protections. [This is known as hormesis]

13) There is an unwarranted fear of low-dose radiation.

14) The authors note that the Biologic Effects of Ionizing Radiation Committee operates under the auspices of the National Academy of Sciences, receiving significant financial support from various regulatory and other government agencies, and that thousands of government and private industry jobs depend on the conclusions of the BEIR Report, which promotes acceptance of the LNTH. Yet, the 2005 French Academy of Sciences Report disagrees, finding no valid evidence for harm below 100 mGy, and they questioned the validity of the LNTH.

15) The body deals with this [radiation] damage through a set of proven mechanisms, collectively called the adaptive response. “Numerous studies demonstrate at least 6 mechanisms for reducing cancer rates and increasing longevity, stimulated by low-dose [radiation] damage.”

16) “Low doses stimulate repair or removal of radiogenic damage in excess of that immediate damage, they provide enhanced protections against additional damage over time, including damage from subsequent higher radiation exposures.”
17) The average annual U.S. background is 3 mSv. “Mutation rates due to the body’s normal metabolic chemistry are a million times higher.”

18) Low-dose chronic radiation exposure is associated with two adaptive cellular responses: enhanced antioxidant defense and increased apoptotic response.

19) “Mutations are necessary, but not sufficient, to produce clinically overt cancer. The immune system generally keeps cancers in check, and cancers develop mainly when the immune system is suppressed.” “Low-dose radiation has been shown to stimulate the immune system, causing a reduction in cancer rates.”

20) Evidence shows that low-dose carcinogenicity is invalid up to approximately 200 mGy. “Thus, the much lower doses from medical imaging of children and adults should not be feared or avoided for radiophobic reasons.”

21) Large epidemiologic studies suggesting an increased low-dose cancer risk associated with pediatric CT scans “have been effectively rebutted.”

22) “The declaration that the LNTH provides ‘known’ cancer risks due to imaging must stop.” “The use of the LNTH and the advocacy for ALARA dosing by various groups are misguided and not science- or evidence-based.”

23) “Medical imaging is said to carry an iatrogenic risk of cancer from radiation exposure. But credible evidence of cancer risk from imaging, particularly CT and PET/CT scans, is nonexistent; this risk is an imaginary prediction derived from the demonstrably false LNTH. Low-dose radiation from these scans does not cause, but more likely helps prevent, cancer.”

24) “Actual risk arises from radiophobia through patients’ fear-driven imaging avoidance and physician-recommended substitution of alternative procedures.”

[Key Point]

25) “The only rational and public-health-protective conclusion is that subjecting the life-saving practice of medical imaging to the LNTH is a non sequitur. Medical imaging must no longer suffer in the longstanding thrall of the LNTH.”

COMMENTS FROM DAN MURPHY

Chiropractors expose radiographs not for assessment of congenital anomalies, degenerative conditions, and pathology, but also to assess biomechanical abnormalities that may enhance the specificity of the mechanical approach to treatment. Post-treatment radiographs can also document biomechanical improvements. Future radiographs can document progression of degenerative changes.

This article makes a strong argument why such exposures should not be avoided based upon fear of radiation, what this article refers to as “radiophobia.”