


Letter re: “On Geraily et al - Comments”

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I wish to offer two comments to the article *Assessing the Risk of Secondary Cancer Induction in Radiosensitive Organs During Trigeminal Neuralgia Treatment With Gamma Knife Radiosurgery: Impact of Extracranial Dose*, by Ghazale Geraily et al, recently published in *Dose Response*.¹ While I find the methodology applied to establish the values and distribution of extracranial doses incurred by the eye, thyroid, uterus, and ovary of patients undergoing Gamma Knife radiosurgery treatment of trigeminal neuralgia quite satisfactory, the $1/r^2$ dependence of assessed dose to these organs on their distance from the target volume shown in Figure 5 would be represented more convincingly if plotted using logarithmic scales on the dose and distance axes. In such a double-logarithmic plot, the $1/r^2$ dependence would present as a line of negative slope 2 and the values of organ doses, as assessed by the Authors at various distances, would better illustrate their general dependence.

My second comment, also addressed to the readers of this article, is more general and concerns assessment of risk of secondary cancer induction to patients undergoing radiotherapy treatment. As discussed in more detail in Annex A of UNSCEAR 2012 Report,² there is a fundamental difference between *factual knowledge* allowing one to *attribute* effects (such as cancer) to radiation exposure, and *conjectures* that can be made on these potential effects—which are only helpful in *inferring* risks. In this context, the calculation of Lifetime Attributable Risk (LAR) as given by equation (2) in the article of Ghazale et al clearly represents the *conjecture* of a potential effect rather than an *actual* risk estimate—as equation (2) is not based on *factual* knowledge. To make the reader of the article by Ghazale et al better aware of this difference, my suggestion is to change “Assessing the Risk...” to “Assessing the Nominal Risk...” in their title.

The term “nominal,” commonly applied in technology and every-day life, is perhaps clearer than “conjectural” of

the UNSCEAR 2012 Report. A “nominal (carrying weight)” of a bridge means that the bridge should be able to safely carry such a weight without being damaged, perhaps with an additional safety factor, as planned by the bridge constructors. In radiation protection, where risk calculations are based on linear concepts of low-dose response such as LNT (Linear No Threshold), and linear additivity of effect over lifetime periods, such a “safety factor” with respect to the *actual* risk could easily exceed orders of magnitude—if threshold or power-law dependences in the response of non-linear biological systems in maintaining their homeostasis at low levels of stress are actually observed. There is increasing evidence that biological systems are indeed complex non-linear rather than linear in their response to low doses of ionizing radiation.³ The precautionary (ALARA) principle (or *conjectural* safety factor) applied in medical radiological procedures thus causes undue concern in patients undergoing radiology and radiotherapy procedures and generally results in excessive material and social costs of such radiophobia. Then, adding “Nominal Risk” to the title of the paper of Ghazale et al and a short paragraph in their text, referring to the UNSCEAR 2012 Report² could serve to alleviate this irrational concern with health effects of low doses of ionizing radiation.

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