Response to Comment on - Long-term risks of secondary cancers for various whole and partial breast irradiation techniques

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Letter to the Editor

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We would like to thank and welcome the useful commentary on the article [“*Long-term risks of secondary cancers for various whole and partial breast irradiation techniques*” published in Radiotherapy and Oncology, volume 128, issue 3, pages 428–433], [1,2] regarding the limitations using the BEIR model [3]. It is indeed exact that the model is mainly addressing low-dose exposures and since it is a linear model it fails to incorporate a “saturation” effect beyond a threshold dose it may overestimates the rate of secondary cancers. This is well illustrated in Schneider report on the OEM model where for secondary lung cancer the model is quite linear up to 4–5 Gy then shows an inflexion with a clear saturation after 10 Gy [4]. Since all the doses we measured in the phantom were below 3 Gy, we believe the BEIR model would yield a fair estimation of secondary cancer risk. Also, we believe that the calculation was conservative as our calculated secondary cancer rates appear not overestimated but slightly underestimated. Both Grantzau meta-analysis and the EBCTCG reported secondary cancers rates after breast radiotherapy slightly higher than the one we calculated [5,6].

The OED model cited in the commentary is a powerful and sophisticated one, as it refines the BEIR model including dose distribution heterogeneity. The challenge being that it assumes all the mechanisms of response to an irradiation, at the molecular, cellular, and physiological, which occur over several decades, are fully understood and included in a mathematical model. It also assumes that each organ would be constituted by single elementary units behaving similarly.

While those models are very useful, it is critically important to acknowledge that they remain theoretical and cannot accurately calculate an absolute risk for a given irradiation situation. But they can yield rough risk estimates and enable a fair comparison between radiotherapy techniques. It is hence unsure that using another model than the BEIR VII would change the conclusions that (i) lung is the main organ at risk of secondary cancer, (ii) there is a prolong lag of time for the development of secondary cancers, (iii) the rough estimate risk of secondary radiation induced lung cancer death after 30 years largely overpass the risk of cardiac mortality so it is important to disclose this discussing a radiation treatment with a young women with highly curable disease such as DCIS and to take active measure to reduce the amount of scattered dose in the lung; and finally (iv) comparing breast irradiation techniques leads to very different risks of secondary lung cancers favoring partial breast irradiation.

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