Meeting Report

Linear No-Threshold and Radiation Hormesis

The Society for Radiation Research (SRR) in association with the Society for Cancer Research and Communication organized a meeting on “Revisit of Linear No-Threshold (LNT) and Radiation Hormesis” on December 7, 2019, in Mumbai. The meeting was one of the events in the series of activities organized by the SRR during its 5th Foundation Year in 2019. The program was attended by about forty eminent scientists, engineers, clinicians, and other professionals from various institutes and hospitals (such as Bhabha Atomic Research Centre [BARC]; Nuclear Power Corporation of India Limited; Atomic Energy Regulatory Board; Advanced Centre for Training, Research and Education in Cancer [ACTREC]; Indian Institute of Technology, Mumbai; Nanavati Hospital; and Nair Hospital) in Mumbai.

Dr. Nagraj Huilgol, Radiation Oncologist, Nanavati Hospital, Mumbai, and Ex-President, SRR, during his introductory remarks highlighted about the historical Muller’s radiobiological experiments using fruit fly at high doses of radiation, which were later used to extrapolate the effects at low doses and became the basis for LNT model for radiation risk assessment.[1] He mentioned that such models created a fear against radiation in public, and there is a need to develop a model, which should not only ensure the safety of workers and public but also be more rationale based on the plenty of data available in low-dose radiation biology.

An invited talk titled “Linear No-Threshold Model of Radiation Risk Assessment: A Need to Balance Science Over Argument” was delivered through Skype by Dr. Jerry Cuttler, Cuttler and Associates Inc., Ontario, Canada. During the lucid and interesting talk, Dr. Cuttler covered the historical aspects of medical treatments with low radiation doses and presented some recent case studies of low-dose radiation/radionuclide-based treatment of ailments such as cancer and Alzheimer’s disease. Dr. Cuttler mentioned that the threshold for malignancies was found to be 100 μCi in radium dial painters who had radium intake in the early 19th century. He mentioned that since discovery, radiation had been used to treat various ailments (cancer, accelerated wound healing, infections, arthritis, etc.) for more than 120 years; however, there was little evidence of increased cancer in these patients. In case of nasopharyngeal radiation irradiation, many follow-up studies did not show any link to any disease in these patients despite the short distance to the brain, the eyes, and the thyroid from the site of radium administration. Dr. Cuttler mentioned that due to the use of the LNT model to assess the risk of radiation effects, a well-established concept of radiation-induced stimulation of immune system was masked over the risk of mutation/cancer incidence after low-dose therapy. It resulted in the shift of clinicians toward antibiotics and anticancer agents rather than to further explore the potential of low-dose radiation. Dr. Cuttler mentioned that low-dose total body irradiation has been shown to suppress both artificial and spontaneous lung cancer metastases in marine squamous cell carcinoma.[2] He described the study showing the prevention of prostate cancer metastasis after low-dose total body irradiation. Some recent case studies were explained by Dr. Cuttler which employed alpha-emitting radon generators for the prevention of breast cancer growth and metastasis. Use of radon therapy for the treatment of arthritis and pemphigus, an autoimmune disease, was explained by Dr. Cuttler. At the last part of his presentation, Dr. Cuttler showed some recent case studies to use low-dose brain computed tomography for the treatment of Alzheimer’s dementia and Parkinson’s disease, which showed improvement in symptoms and helped lowering the routine medications.[3]

The invited talk of Dr. Cuttler followed a panel discussion on “Revisit of LNT and Radiation Hormesis” with eminent panelists (Dr. K. P. Mishra, Ex-Vice Chancellor, Nehru Gram Bharati University, Allahabad, and Ex-Head, RB and HSD, BARC, Mumbai; Dr. Nagraj Huilgol, Chief Radiation Oncologist, Nanavati Hospital, Mumbai; Dr. Pushparaja, Ex-Head, Radiation Hazards Control Section, BARC, Mumbai; Dr. B. S. Rao, Ex-Head, Radiation Physics and Advisory Division, BARC, Mumbai; and Dr. J. Sastry, Radiation Oncologist, ACTREC, Navi Mumbai), which was steered by Dr. B. N. Pandey, RB and HSD, BARC, Mumbai. During the scientific discussion, the panelists opined that the existing LNT is a conservative model of radiation risk assessment. Radiation oncologists (Dr. Huilgol and Dr. Sastry) suggested that knowledge gained about the effects of different doses of radiation during cancer radiotherapy should be used to understand the risk of low dose of radiation. Dr. K. P. Mishra opined that LNT model resulted in undesired fear against low dose of radiation, especially after the Fukushima Nuclear accident. It was also discussed by the panelists that the LNT model overlooks some of the basic radiation biological concepts and the multistep process of carcinogenesis.

The meeting concluded with a note that evidences from in-vitro, in-vivo, and epidemiological sources suggest...
that there is an urgent need to revisit the existing LNT model toward a threshold-based model for radiation risk assessment.

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**Conflicts of interest**
There are no conflicts of interest.

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