

Nuclear terrorism perception: Some strategies and recommendations to handle a disaster scenario*

The Indian Society for Radiation Biology (ISRB) organized a workshop on 'Radiation Risk in the Age of Nuclear Terrorism'. Forty participants, including thirteen invited speakers/panellists representing India, Germany, Canada, Japan and USA, attended the workshop. The speakers covered various aspects of radiation-risk assessment in a nuclear disaster scenario in the six technical sessions of the workshop. R. N. Sharan, President (ISRB), in his opening remarks, highlighted the need and urgency of the workshop and discussed its scope. The inaugural lecture was delivered by P. N. Srivastava (formerly Vice-Chancellor of JNU, Member of the Planning Commission and President of ISRB). Srivastava recalled the chronological events of the past, where large segments of population across the globe were exposed to heavy doses of radiation. K. A. Dinshaw (Director, Tata Memorial Centre, Mumbai) delivered a thematic talk titled 'Managing radiation emergencies – a physician's view' covering all aspects of health management during and after a nuclear holocaust.

The next four sessions covered various aspects of consequences of radiation exposure, new approaches to biological dosimetry, biological responses and radioprotection strategies, wherein nine invited speakers delivered their talks. A. Trivedi (Health Canada, Ottawa) presented new strategies for radiation risk assessment in the moderate-dose range of 1–10 Sv – doses that are not lethal, but which can potentially cause acute effects as cells continue to survive. K. P. Mishra (BARC, Mumbai) detailed the need for more extensive research to elucidate the role of free radicals in the induction of membrane and DNA damages which provide better understanding of apoptotic death and bystander effects. R. N. Sharan (NEHU, Shillong) presented evidence

of nucleotide sequence-determined vulnerability of segments of genomic DNA, suggesting that genome instability or inherent radiosensitivity may be, at least in part, determined by the primary sequence of nucleotides. M. S. Sasaki (University of Kyoto, Kyoto) presented a new model of biological dosimeter for a non-homogeneous radiation exposure situation like the one during a nuclear holocaust. The strategy is based on scoring chromosome aberrations in lymphocytes and spreading it over a mixed Poisson distribution into dose component to get the most likely dose–response curve and a realistic biological dose assessment. F. H. A. Schneeweiss (Research Centre, Juelich GmbH, Juelich) offered an alternative to this approach in which early cellular response could be assessed by analyses of lymphocyte proteins by two-dimensional differential gel electrophoresis and mass-spectrophotometer coupled with COMET-FISH analysis of DNA damage.

P. Uma Devi (J. N. Cancer Hospital and Research Centre, Bhopal) presented results of research involving prenatal exposures of mice and cancer incidence. Prenatal exposure was shown to significantly increase genome instability. R. K. Kale (JNU, New Delhi) presented evidence of xanthine oxidoreductase system producing free radicals in the post-irradiation period, suggesting that inhibition of the system may contain radiation damage in the post-irradiation period. B. S. Dwarkanath (Institute of Nuclear Medicine and Allied Sciences, Delhi) discussed possible use of minor groove-binding DNA ligands, such as Hoechst 33258 and 33342, in protection of radiation-induced DNA damage. The Hoechst ligands were shown to scavenge free radicals as well as afford stabilization to DNA superstructure. A. Chatterjee (NEHU, Shillong) elaborated on the use of endogenous radioprotector, GSH, in reducing post-irradiation damage to proliferating cells.

The final technical session of the workshop was in the form of a plenary discussion with panellists Srivastava, Sasaki, Schneeweiss, Trivedi and Vijayalaxami. The session was initiated by a short

presentation on 'Chemical, biological, radiological and nuclear research and technology initiative' by Trivedi. The deliberation made several recommendations:

(i) International collaborations/partnerships, network and communication channels be initiated and strengthened for free exchange of information and for collaborative research.

(ii) Preparedness – In this domain, the following steps be initiated: (a) Public awareness initiatives for imparting correct perspectives on effects of radiation and perspective on nuclear disaster and its management; (b) School children awareness initiatives to foster and strengthen concepts and possibilities of peaceful uses of nuclear energy and alleviate unfounded fear of the public on harmful effects of radiation.

(iii) First response team be created and kept in readiness at various locations, especially in metropolis and big cities. Appropriate 'first action manual' be prepared for the teams.

(iv) Existing hospitals in different metropolis and big cities be categorized and equipped for handling various categories of patients and different degrees of emergencies.

(v) Specialized trauma control hospitals be developed for trauma control.

(vi) Development of biological dosimeters with field applicability to assess the extent of biological damage in a disaster situation.

(vii) Radiomodulatory drugs for post-exposure treatment needs urgent attention. Endogenous or exogenous radioprotectors, free radical scavenging drugs of high efficiency and nucleotide modifiers need to be developed and tested.

The recommendations are especially relevant to India due to its vulnerability, large population, geographical spread and largely inadequate medical infrastructure.

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