

Assessment of radiation damage – the need for a multiparametric and integrative approach with the help of both clinical and biological dosimetry

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Accidental exposure to ionising radiation leads to a damage on different levels of the biological organization of the organism. Depending on exposure conditions, such as nature of radiation, time and affected organs and organ systems, the clinical endpoint of radiation damage and the resulting acute and chronic radiation syndromes may vary to a great extent. Exposure situations range from pure localised radiation scenarios and partial body exposures up to whole body exposures. Therefore clinical pictures vary from localized radiation injuries up to the extreme situation of a radiation-induced multi-organ involvement and -failure requiring immediate, intensive and interdisciplinary medical treatment. These total different and complex clinical situations not only show up most different clinical diagnostic and therapeutic aspects but necessarily due to different levels of the underlying biological damage, biological indicators of effects may vary to a wide extent. This fact means that an exact assessment of the extent of radiation damage within individual patients can only be performed when taking into consideration both clinical as well as different biological indicators. Among the clinical indicators, routine laboratory parameters such as blood counts and the documentation of clinical signs and symptoms (such as the METREPOL system) are the key parameters, whereas the dicentric assay, the gold standard for biological dosimetry, but also methods under development such as the gamma-H2Ax focus assay or gene expression analysis (e.g. GADD 45, CDKN1A etc.) have to be taken into account. Each method provides best results in different situations, or in other words, there are methods that work better in a specific exposure condition or at a given time of examination (e.g. time after exposure) than others. Some methods show up results immediately, others require days to weeks until results are available for clinical decision making. Therefore to provide the best basis for triage and planning and providing of medical treatment after accidental radiation exposure always different and independent diagnostic procedures integrating all clinical aspects as well as different biological indicators have to be applied.

Up to now this multiparametric approach is missing in medical radiation accident management. A new integrative concept is shown and discussed.

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