

Title:

Early Biomarkers for Rapid Assessment of Radiation Exposure in Nuclear Emergencies.

Abstract:

In the event of a nuclear emergency, rapid and accurate assessment of radiation exposure is crucial for effective medical intervention. Current biomarkers and software solutions are limited by their ability to provide dose information only after 24-50 hours post-exposure. To address this limitation, we conducted a study to validate a novel panel of early biomarkers for rapid dose measurement shortly after radiation. Seventy patients were enrolled from Istituti Fisioterapici Ospitalieri—Istituto Nazionale Tumori “Regina Elena” (IRE-IFO) in Italy and Alexandria University Hospital in Egypt. Patients were divided into dose groups based on their exposure levels. Blood samples were collected before, 3hrs and 24 hours after radiotherapy using BD Vacutainer®. A comprehensive set of biomarkers including CBC, DNA breaks (Comet assay), amylase, FLT3-L, citrulline, IL1B, IL6, IL8, zinc, and copper were analyzed. The reference MN count assay was used for validation.

Results showed that the novel panel of early biomarkers provided rapid and reliable dose information. The biomarkers exhibited non-overlapping kinetics and peaks of expression, enhancing the reliability of identifying a suitable tool for radiation emergencies, and the result of 24 hrs is validated. Patient dosimetry was calculated based on DICOM data, and treatment plans were generated and delivered using specific treatment planning systems at each institution.

In conclusion, the study validates a novel panel of early biomarkers for rapid assessment of radiation exposure in nuclear emergencies. These biomarkers offer a potential solution for timely allocation of medical resources, ultimately improving patient outcomes in nuclear or radioactive emergencies.

Keywords: radiation exposure, nuclear emergencies, biomarkers, rapid assessment, patient dosimetry

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