NERIS

NERIS Workshop 2017

17-19 May 2017
Lisbon, Portugal

Abstract Template

Please select one or more topics for your abstract

X	RADIOLOGICAL IMPACT ASSESSMENTS
X	COUTERMEASURES AND COUTERMEASURE STRATEGIES IN EMERGENCY & RECOVERY, DECISION SUPPORT & DISASTER INFORMATICS
	SETTING-UP A HOLISTIC FRAMEWORK FOR PREPAREDNESS FOR EMERGENCY RESPONSE & RECOVERY
	STAKEHOLDER INVOLVEMENT AND ENGAGEMENT IN EMERGENCY AND RECOVERY
	UNCERTAINTY HANDLING ISSUES FOR EMERGENCY AND RECOVERY

Title: Rapid prediction of haematological acute radiation syndrome in radiation injury patients using peripheral blood cell counts

Authors:

M. Port[1], B. Pieper[1], T. Knie[1], H. Dörr[1], A. Ganser[2], D. Graessle[1,3], V. Meineke[1] and M. Abend[1]

[1]Bundeswehr Institute of Radiobiology, Germany
[2]Department of Hematology, Hemostasis, Oncology, and Stem Cell Transplantation, Hannover Medical School, Germany
[3]Radiation Medicine Research Group of the Faculty of Medicine, Ulm University, Germany, and World Health Organization Liaison Institute for Radiation Emergency Preparedness, Germany

Text

Rapid clinical triage of radiation injury patients is essential to determine appropriate diagnostic and therapeutic interventions. We examined the utility of blood cell counts (BCC) in the first three days after irradiation to predict clinical outcome, specifically haematological acute radiation syndrome (HARS).
Material and Methods: For the test sample we analyzed BCC from radiation accident victims (N = 135) along with their clinical outcome HARS severity scores H1-4 using the database SEARCH (System for Evaluation and Archiving of Radiation Accidents based on Case Histories). Data from unirradiated individuals (H0, N=132) were collected from an out-patient facility. We created binary categories of (1) H0 versus H1-4, (2) H0-1 versus H2-4 and (3) H0-2 versus H3-4 severity scores to assess the discrimination ability of BCC using unconditional logistic regression analysis. The test sample contained 454 BCC from 267 individuals. We validated the discrimination ability on a second independent group comprising 275 BCC from 252 individuals originating from SEARCH (HARS 1-4), an outpatient facility (H0) and hospitals (e.g. leukemia patients, H4).

Results: Those individuals with H0 score were easily separated from exposed persons based on developing lymphopenia and granulocytosis. The separation of H0 and H1-4 became more prominent with increasing hematological severity scores and time. On the first day, lymphocyte counts were most predictive for discriminating binary categories followed by granulocytes and thrombocytes. For days 2 and 3, an almost complete separation was achieved when combining BCC from different days, supporting the measurement of sequential BCC. We found an almost complete discrimination of HO versus radiation exposed individuals during model validation (negative predictive value, NPV >94%) for all three days while the categorization correct prediction of radiation exposed individuals increased from day 1 (positive predictive value, PPV 78-89%) to day 3 (PPV > 90%). The models were unable to provide predictions for 10.9% of the test samples, because the PPVs or NPVs did not reach a 95% likelihood defined as the lower limit for a prediction. We developed a prediction model spreadsheet to provide early and fast diagnostic predictions and therapeutic recommendations.

Conclusion: Clinical outcome of radiation injury patients can be rapidly predicted within the first 3 days after radiation exposure using peripheral BCC.