Automated micronucleus (MN) scoring for population triage in case of large radiation accidents.

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In case of a large radiation accident, when hundreds of people may be exposed, it is very important to distinguish the severely exposed individuals, who require early medical treatment, from those less exposed. In such a situation, specific biological indicators should promptly indicate whether the whole-body dose received by the victims exceeded 1Gy, the level above which it is necessary to provide medical care. Once the exposed population has undergone such an early triage, a second step may be indicated for a more accurate assessment of the exposure. Up to now, scoring of dicentrics is the reference to estimate the dose received in case of individual overexposures. However, to obtain a reliable dose estimate, 500 metaphases should be screened for the presence of dicentrics, a very time consuming procedure, that can only be applied to small populations of exposed individuals. The aim of our study was to develop a quick population triage method based on automated micronucleus (MN) scoring. Automated MN scoring was performed using a MN software module specifically developed by Metasystems for the Metafer4 platform. Standard dose response curves were established for manual, automated and semi-automated MN scoring. To this aim, blood samples of 10 individuals were irradiated with in vitro doses of 0-0,2-0,5-1-2-3Gy Co-60 γ-rays. Whole blood cultures were set up and cells were harvested after 70h, applying rigorous culture/harvest conditions. Cells were stained with DAPI for manual and automated scoring. For both scoring methods 500 binucleated (BN) cells were counted. The reproducibility, accuracy and sensitivity of the manual versus automated scoring procedure were analyzed. A comparison between manual and automated scoring of the same slides, revealed a drop in the MN yield for the automated scoring procedure. However, the automated scores were as reproducible as the manual scores and both scores were highly correlated. Scoring of 500 BN cells allows us to detect a dose of 0,5 Gy, with 95% confidence, for both manual and automated MN scoring procedures (Mann-Whitney U test, $p<0.05$). The semi-automated scoring procedure, taking into account false positives and false negatives in the MN class, didn't result in a better accuracy or reproducibility. With the automated MN scoring procedure, about 80 slides (500 BN cells) can be scored in 1 day with the Metafer4. In conclusion, our preliminary results show that automated MN scoring is a quick and reliable method, useful for a first population triage in case of large radiation accidents.

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