Investigating micronucleus assay applicability for prediction of normal tissue intrinsic radiosensitivity in gynecological cancer patients
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ABSTRACT

Background Pelvic organs morbidity after irradiation of cancer patients remains a major problem although new technologies have been developed and implemented. A relatively simple and suitable method for routine clinical practice is needed for preliminary assessment of normal tissue intrinsic radiosensitivity. The micronucleus test (MNT) determines the frequency of the radiation induced micronuclei (MN) in peripheral blood lymphocytes, which could serve as an indicator of intrinsic cell radiosensitivity.

Aim: To investigate a possible use of the micronucleus test (MNT) for acute radiation morbidity prediction in gynecological cancer patients.

Materials and methods: Forty gynecological cancer patients received 50 Gy conventional external pelvic irradiation after radical surgery. A four-field “box” technique was applied with 2D planning. The control group included 10 healthy females. Acute normal tissue reactions were graded according to NCI CTCAE v.3.0. From all reaction scores, the highest score named “summarized clinical radiosensitivity” was selected for a statistical analysis. MNT was performed before and after in vitro irradiation with 1.5 Gy. The mean radiation induced frequency of micronuclei per 1000 binucleated cells (MN/1000) and lymphocytes containing micronuclei per 1000 binucleated cells (cells with MN/1000) were evaluated for both patients and controls. An arbitrary cut off value was created to pick up a radiosensitive individual: the mean value of spontaneous frequency of cells with MN/1000 ± 2SD, found in the control group. Both mean spontaneous frequency of cells with MN/1000 and MN/1000 were registered to be significantly higher in cancer patients compared to the control group ($t = 2.46, p = 0.02$ and $t = 2.51, p = 0.02$). No statistical difference was registered when comparing radiation induced MN frequencies between those groups. Eighty percent (32) of patients developed grade 2 summarized clinical radiosensitivity, with great variations in MNT parameters. Only three patients with grade 2 “summarized clinical radiosensitivity” had values of cells with MN/1000 above the chosen radiosensitivity threshold.

Conclusion: The present study was not able to confirm in vitro MNT applicability for radiosensitivity prediction in pelvic irradiation.
Keywords: Pelvic irradiation, Normal tissue radiosensitivity, Micronucleus test, Predictive methods