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In-vivo visualization of radiation-induced apoptosis using (125)I-annexin V.

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BACKGROUND: As apoptosis occurs in tumors within a short time after irradiation, the detection of the frequency of apoptosis may be useful as an indicator of the effect of treatment. For the evaluation of apoptosis under these conditions, tissue extraction from patients is indispensable. AIM: To develop a noninvasive imaging technique to measure and monitor apoptosis in tumor cells caused by X-irradiation using (125)I-radiolabeled annexin V. METHODS: The tumors used were human ependymoblastomas, which were transplanted into nude mice. The tumors were irradiated at 2, 5 or 10 Gy. (125)I-annexin V was administered intravenously 6 h after irradiation. In the 5 Gy irradiation group, the isotope was injected at various time intervals (3, 6 and 12 h) after irradiation. Three hours after the injection, the mice were sacrificed, the tumors were quickly removed and frozen sections were prepared at 6 and 40 microm thickness using a cryomicrotome. In autoradiographic imaging, the tumor-to-muscle ratios were compared in the respective irradiated groups. In addition, apoptosis detection by the in-situ end-labeling (Klenow) assay was conducted on the same sections. The number of Klenow-positive cells was counted in 100 x fields for each section. RESULTS: Both autoradiography and immunohistochemical staining showed a significantly higher frequency of apoptosis in the neoplasms in all irradiated groups than in the control group ($P<0.05$). Although immunohistochemical staining revealed a peak apoptosis frequency in the 5 Gy irradiated group, autoradiography revealed a peak in the group receiving a lower dose than 5 Gy. When the time from irradiation to annexin injection was varied, both imaging methods showed a peak apoptosis frequency in the group receiving the injection 6 h after irradiation. CONCLUSION: It is possible to predict the effect of treatment in cancer in a noninvasive manner by apoptosis imaging in vivo after radiotherapy.

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