

Radiosurgery and Carcinogenesis Risk

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Abstract

The definition of radiation-induced tumors is based on indirect criteria. They were defined initially by Cahan: the tumors must occur at the irradiated site after a time of latency longer than 5 years and be of a different pathological type from the initially irradiated tumor. The central nervous system belongs to sensitive tissue and it seems that a threshold dose does not exist. Thus, the relative risk varies from 1.57 to 8.75 for a dose of 1 Gy. It increases with the time of observation with a maximum of 18.4 between 20 and 25 years. Thus the cerebral radiation-induced tumors would be dependent on low dose for large volumes of healthy cerebral tissue (tinea, acute leukemia), and high dose for small volumes as irradiated benign lesions (pituitary tumors, meningiomas). Several factors influence the incidence of these radiation-induced tumors, of which the age at exposure and individual susceptibility are related to heredity. To date, 3 cases of radio-associated glioblastoma and 5 cases of transformed vestibular schwannoma related to radiosurgery were reported in the literature. They do not present all the traditional criteria. Thus, we reported through our experience 2 cases illustrating these problems to confront them with the published data. The long-term risk of radiation-induced tumor requires a time of observation between 5 and 30 years. This risk is estimated at less than 1 per 1,000. It must be communicated to each patient and counterbalanced with the operational risk of a benign tumor (1 per 100 of perioperative mortality) or the hemorrhagic risk of an untreated arteriovenous malformation (1 per 100 per year).

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The use of ionizing radiation for benign diseases of the nervous system poses an increasing risk of

primary nervous system tumors. The radiation-induced tumors vary substantially and do not have a specific pathological characteristics. The absence of a clear definition underlines the difficulty in distinguishing a radiation-induced tumor from a second spontaneous tumor. The role of radiotherapy in the development of a second tumor could perhaps be suspected by the increase in the incidence and specific mortality associated with each tumor compared to a control population. Thus, the solid tumors induced by the therapeutic medical use of the ionizing radiations were the subject of relatively recent epidemiologic studies. This is related to the time of appearance and the difficulty in isolating them from the spontaneous secondary tumors. Cahan et al. [1] defined indirect criteria to define radiation-induced sarcomas and other radiation-induced tumors. Those tumors must occur at the irradiated site after a time of latency higher than 5 years, and the pathological type must be different from the initially irradiated tumor. It is necessary to verify the absence of a second tumor at the time of radiotherapy and the absence of a pathology associated with a high susceptibility to develop tumor: Recklinghausen's disease, Li-Fraumeni syndrome, tuberous sclerosis, xeroderma pigmentosum, retinoblastoma or genetic predisposition. Several epidemiologic studies have reported