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Secondary cancer risk assessment in healthy organs following craniospinal irradiation

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Abstract

Introduction: Medulloblastoma is a central nerves tumor that often occurs in pediatrics. The main radiotherapy technique for this tumor type is craniospinal irradiation (CSI), through which the whole brain and spinal cord are exposed to radiation. Due to the immaturity of healthy organs in pediatrics, radiogenic side effects such as second cancer are more severe. Accordingly, the current study aimed to evaluate the risk of secondary cancer development in healthy organs following CSI.

Materials and methods: Seven organs at risk (OARs) including skin, eye lens, thyroid, lung, liver, stomach, bladder, colon, and gonads were considered and the dose received by each OAR during CSI was measured inside an anthropomorphic RANDO phantom by TLDs. Then, the mean obtained dose for each organ was used to estimate the probability of secondary malignancy development according to the recommended cancer risk coefficients for specific organs.

Results: The results demonstrated that the stomach and colon are at high risk of secondary malignancy occurrence, while the skin has the lowest probability of secondary cancer development. The total received dose after the treatment course by all considered organs was lower than the corresponding tolerable dose levels.

Conclusions: From the results, it can be concluded that some OARs during CSI are highly at risk of secondary cancer development. This issue may be of concern due to organ immaturity in pediatrics which can intensify the radiogenic effects of radiation exposure. Accordingly, strict shielding the OARs during craniospinal radiotherapy and/or sparing them from the radiation field through modern techniques such as hadron therapy is highly recommended.

Keywords: CNS tumors; TL dosimetry; craniospinal radiotherapy; medulloblastoma; secondary cancer risk assessment.

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