

# Growth hormone treatment and risk of recurrence or progression of brain tumors in children: a review

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## Abstract

**Introduction** Brain tumors are one of the most common types of solid neoplasm in children. As life expectancy of these patients has increased with new and improved therapies, the morbidities associated with the treatments and the tumor itself have become more important.

**Discussion** One of the most common morbidities is growth hormone deficiency, and since recombinant growth hormone (GH) became available, its use has increased exponentially. There is concern that in the population of children with brain tumors, GH treatment might increase the risk of tumor recurrence or progression or the appearance of a second neoplasm. In the light of this ongoing concern, the current literature has been reviewed to provide an update on the risk of tumor recurrence, tumor progression, or new intracranial tumor formation when GH is used to treat GH deficiency in children, who have had or have intracranial tumors.

**Conclusion** On the basis of this review, the authors conclude that the use of GH in patients with brain tumor is safe. GH therapy is not associated with an increased risk of central nervous system tumor progression or recurrence, leukemia (de novo or relapse), or extracranial non-leukemic neoplasms.

**Keywords** Brain tumor · Growth hormone · Tumor recurrence · Tumor growth · Second neoplasm

## Introduction

Brain tumors are the most common type of solid neoplasms that occur in children. The incidence of brain tumors is 4.0 per 100,000 in children less than 5 years of age and approximately 2.5 per 100,000 in older children [3]. New therapies for childhood cancer have increased the number of long-term survivors. The 5-year relative survival probability for all brain malignancies combined for children is approximately 65% [9]. Currently, one in 900 young adults is a childhood cancer survivor [17]. As survivals have improved, the short- and long-term morbidities associated with the treatments used for childhood brain tumors have become more important [2].

Among the most common problems in this population are endocrine deficiencies. The Childhood Cancer Survivor Study (CCSS) reported that 43% of brain tumor survivors had one or more endocrinopathies [12]. The endocrine sequelae are associated with both the type and location of the tumor. Treatment modality (e.g., surgery, radiotherapy, chemotherapy) also influences endocrine outcome. Growth hormone (GH) deficiency is one of the most common endocrinopathies noted in the brain tumor survivor population. Such GH deficiency may occur in children with tumors involving the hypothalamus and pituitary due to the tumor itself or as a complication of surgical resection, local radiotherapy, or other treatments. However, most commonly, GH deficiency arises after irradiation of the hypothalamic–pituitary axis during radiotherapy for a tumor remote from the hypothalamo–pituitary axis. The frequency and onset of growth hormone deficiency (GHD) are affected by the

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