

## **Growth and Endocrine Disorders Secondary to Cranial Irradiation**

Rappaport and Brauner present data from the literature and their own studies concerning cranial and spinal irradiation therapy and its effect on growth and pubertal development. Of a group of children given 2,400 rad as prophylactic irradiation for acute lymphoblastic leukemia, 56% had growth hormone (GH) deficiency with a peak GH response to arginine-insulin of  $<8$  ng/mL. Complete GH deficiency (two consecutive GH peak responses  $<5$  ng/mL) was observed in 30% of the same population. Eight children treated with

1,800 rad had normal GH responses at least 4 years after radiation. In addition, normal GH secretion was found in a group of children treated for retinoblastoma who received  $<2,000$  rad. All children who received  $>4,500$  rad for optic glioma had GH deficiency. Younger children were reported to be more vulnerable to the effects of radiation than older children or adults. In addition, the timing of the occurrence of GH deficiency was reported to be related to the radiation dose. GH deficiencies may appear during the first year after radiation in patients receiving more than 4,500 rad, and most of these children are GH deficient within 2 to 3 years. In the authors' experience, GH deficiency will almost always

appear within 5 years of radiation, and no affected child has resumed GH secretion. The authors also discussed the use of different stimulation tests, plasma insulin-like growth factor I values, and possible mechanisms for GH deficiency.

Pubertal development also was discussed. Five of 45 children treated with 2,500 to 5,000 rad before or during puberty showed complete gonadotropin deficiency at pubertal ages, while two children had partial gonadotropin deficiency. Diabetes insipidus has not been reported after cranial irradiation and hypothyroidism is infrequent.

Growth after cranial irradiation was dose dependent. Radiation doses in excess of 3,000 rad will

reduce final height in most children, whereas low-dose cranial irradiation (1,800 to 2,400 rad) produces variable responses. Spinal irradiation may have an effect on sitting height that is independent of GH deficiency and that results from decreased growth of the spine.

The final section of this report deals with GH therapy in cranial-irradiated children. Although patients initially have catch-up growth, the authors' data (unpublished) confirm that prolonged GH therapy does not significantly improve the mean height SDs of

patients given cranial and/or spinal irradiation. The possible reasons for this include 1) a shorter duration of GH deficiency, 2) a less retarded bone age at the onset of GH therapy, 3) a lower initial (first year) growth velocity response, and 4) the presence of early puberty, which had accelerated bone age faster than the growth velocity. Despite these less than optimal responses, the authors state that it is essential to begin GH therapy as soon as growth velocity declines and radiation therapy has been concluded. They consider treating

any child with a height loss of 1 SD or more who has proven GH deficiency. The follow-up period after radiation must be 2 years or more.

Rappaport R, Brauner R. *Pediatr Res* 1989;25(6):561-567.

**Editor's comment**—*This paper presents few new data, but it is a good review of the effects of cranial spinal irradiation on GH secretion and pubertal development. As such, it is quite comprehensive and deserving of close scrutiny.*

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