

Purpose: Radiation treatment for localized pure germinoma includes treatment to the whole ventricles followed by a boost to the tumor. Our goal was to compare Volumetric Modulated Arc Therapy (VMAT) with 3D conformal radiation therapy (3DCRT) in the treatment of these children. We compared coverage of the target, doses to normal tissues, and modeled the effect of the dosimetric differences on IQ.

Methods: Ten children with intracranial germinomas were used. The prescription doses was 23.4 Gy to the ventricles followed by 21.6 Gy to the tumor located in the pineal region. For each child, two-lateral 3DCRT plans (CMS XiO, Version 4.4) and full arc VMAT plans (MONACO, Version 2.03.01) were generated. Coverage of the target was assessed by computing a conformity index (CI) and heterogeneity index (HI). Mean dose to the temporal lobe was used to estimate IQ five years after completion of radiation, using a patient age of 10 years old.

Results: VMAT compared to the 3DCRT plan improved conformality (CI 1.85 versus 1.10), with similar heterogeneity (HI 1.09 versus 1.06). The averaged mean doses for left and right temporal lobes were 31.3 and 31.7 Gy for VMAT plans and 37.74 and 37.6 Gy for the 3DCRT plans. This difference in mean temporal lobe dose resulted in an estimated IQ difference of 3.1. If the temporal lobes were explicitly included in the VMAT optimization, for a representative case, the mean temporal lobe dose is further reduced by 5.6 Gy, resulting in an estimated IQ difference of an additional 3.0 points.

Conclusions: For treatment of children with intracranial pure germinomas, VMAT compared to 3DCRT provides increased conformality and reduces doses to the temporal lobes. This may result in improvements in IQ in these children.