

## Low risk of brainstem necrosis with PBS-PT

In children with CNS cancers, pencil beam scanning proton therapy (PBS-PT) has a very low risk of brainstem necrosis, according to a recent study.

Jennifer Vogel (Vanderbilt University Medical Center, Nashville, TN, USA) and colleagues assessed the frequency of brainstem necrosis (defined as symptomatic toxicity) in 166 children and adolescents (aged  $\leq 21$  years) with non-haematological CNS malignancies who underwent PBS-PT (including brainstem irradiation) between 2012 and 2018 at two hospitals in Philadelphia (PA, USA). The histological types of cancers included astrocytoma (n=44), medulloblastoma (n=39), ependymoma (n=26), and germinoma (n=14), among others. The researchers used the Kaplan-Meier method to assess the actuarial incidence of brainstem necrosis.

Median follow-up was 19.6 months (range 2.0–6.0). Median maximum radiation dose to the brainstem (in relative biological effectiveness [RBE]) was 55.4 Gy (range 0.15–61.4). 135 (81%) of 166 patients received more than 50.4 Gy RBE of cumulative brainstem radiation dose. In four (2.4%) patients who had previously received radiotherapy, the cumulative median maximum radiation dose to the brainstem was 98.0 Gy RBE (range 17.0–111.0).

One patient (1%) with medulloblastoma, who previously received radiotherapy, had brainstem necrosis; however, none of the patients who were receiving radiotherapy for the first time had brainstem necrosis. The actuarial incidence of brainstem necrosis in the patient population at 24 months was 0.7% (95% CI 0.1–5.1). In patients who received a cumulative brainstem radiation dose of more than

50.4 Gy RBE, the absolute of brainstem necrosis at 12 months was 0.7% and the actuarial incidence at 24 months was 0.9% (95% CI 0.13–6.3).

Co-author Christine Hill-Kayser (University of Pennsylvania and Children's Hospital of Philadelphia, PA, USA) explained, "Our study demonstrates that the risk of untoward brainstem toxicity can be minimised with use of advanced technology in the setting of a centre with significant experience planning and delivering proton therapy." James Yu (Yale School of Medicine, New Haven, CT, USA) pointed out, "Though not as headline grabbing as the latest and greatest small molecule therapy, we need more National Cancer Institute-supported clinical trials evaluating radiotherapy—even when the randomisation is between two radiotherapy techniques."

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Published Online  
September 19, 2019  
[https://doi.org/10.1016/S1470-2045\(19\)30576-5](https://doi.org/10.1016/S1470-2045(19)30576-5)

For the study by Vogel and colleagues see *Acta Oncol* 2019; published online Sept 12.  
<https://doi.org/10.1080/0284186X.2019.1659996>