Proton radiotherapy (PRT) may lessen the neuropsychological risk traditionally associated with cranial radiotherapy for the treatment of paediatric brain tumours by reducing the dose to normal tissue compared with that of photon radiotherapy (XRT). We examined the change in intellectual scores over time in patients with paediatric medulloblastoma treated with craniospinal PRT versus XRT.

Intelligence test scores were obtained for a sample of paediatric patients treated between 2007 and 2018 on the same medulloblastoma protocols that differed only in radiotherapy modality (PRT versus XRT). Growth curve analyses compared change in scores over time since diagnosis between groups.

Longitudinal intelligence data from 79 patients (37 PRT, 42 XRT) were examined. Groups were similar on most demographic/clinical variables, including sex (67.1% male), age at diagnosis (mean, 8.6 years), craniospinal irradiation dose (median, 23.4 Gy), length of follow-up (mean, 4.3 years), and parental education (mean, 14.3 years). Boost dose (P < .001) and boost margin (P = .001) differed between groups. Adjusting for covariates, the PRT group exhibited superior long-term outcomes in global intelligence quotient (IQ), perceptual reasoning, and working memory compared with the XRT group (all P < .05). The XRT group exhibited a significant decline in global IQ, working memory, and processing speed (all P < .05). The PRT group exhibited stable scores over time in all domains with the exception of processing speed (P = .003).

To our knowledge, this is the first study to compare intellectual trajectories between paediatric patients treated for medulloblastoma with PRT versus those treated with XRT on comparable, contemporary protocols. PRT was associated with more favourable intellectual outcomes in most domains compared with XRT, although processing speed emerged as a vulnerable domain for both groups. This study provides the strongest evidence to date of an intellectual sparing advantage with PRT in the treatment of paediatric medulloblastoma.