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The cochlear dose and the age at radiotherapy predict severe hearing loss after passive scattering proton therapy and cisplatin in children with medulloblastoma

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Abstract

Background: Hearing loss (HL) is associated with worse neurocognitive outcomes among patients with medulloblastoma. We aimed to identify risk factors associated with severe HL and to evaluate the generalizability of a published HL calculator among patients treated with passive scattering proton therapy (PSPT) and cisplatin.

Methods: We identified patients aged 3-21 years who were treated at our centers between 2007-2022. Audiograms were graded using the International Society of Pediatric Oncology-Boston scale. Time to grade 3-4 HL was evaluated using Kaplan-Meier and multivariable Cox models to estimate hazard ratios (HR) and 95% confidence intervals (CI).

Results: Seventy-nine patients were treated with PSPT at a median age of 7.5 years (range:3.1-21.1). The mean cochlear dose (Dmc) (±S.D.) was 31.5±8.5 Gy, and the cumulative cisplatin dose was 295±50 mg/m2. Fifty-nine patients (75%) received amifostine. Patients completed a median of 9 audiograms (range:4-22) with a median audiogram follow-up of 49 months (range:6-177). Twenty-seven patients (34%) had grade 3-4 HL. In adjusted Cox models, only higher Dmc (HR=1.12, 95% CI:1.06-1.18) was associated with grade 3-4 HL. The predicted 3-year incidence of grade 3-4 HL was 40.0% (95% CI: 21.3-66.3) and 66.7% (95% CI: 35.4-93.7) for children with Dmc ≥36 Gy and age at radiotherapy ≥7 and <7 years, respectively (p=0.042). It was 8.9% (95% CI: 2.3-31.6) and 15.6% (95% CI: 5.3-41.1) for children with Dmc <36 Gy and age at radiotherapy ≥7 and <7 years, respectively (p=0.78).

Conclusions: Children <7 years at radiotherapy with a Dmc ≥36 Gy are at higher risk for HL.

Keywords: Hearing loss; Medulloblastoma; Proton Radiotherapy; ototoxicity; passive scattering proton therapy.