

Letter to the Editor

Proton therapy patterns of care among pediatric and adult patients with CNS tumors

Given the lack of exit radiation dose, proton therapy (PT) has been used for primary CNS tumors to minimize dose to adjacent, radiosensitive brain structures. For example, exposure of the hippocampus to even a low radiation dose

has been associated with neurocognitive impairment.^{1,2} While PT efficacy and toxicity for CNS tumors is being studied, data on the patterns of care for PT use is limited and based on only pediatric patients.^{3–5} We used a multicenter registry to identify which CNS patients receive PT and whether differences exist between adult and pediatric CNS PT patients.

Between 2009 and 2017, primary intracranial CNS tumors diagnosed in 1295 patients were treated with PT from 8 community- and academic-based centers on an institutional review board–approved, prospective Proton Collaborative Group (PCG) registry study (NCT01255748). These included the ProCure Proton Therapy Center (PTC)–Oklahoma City,

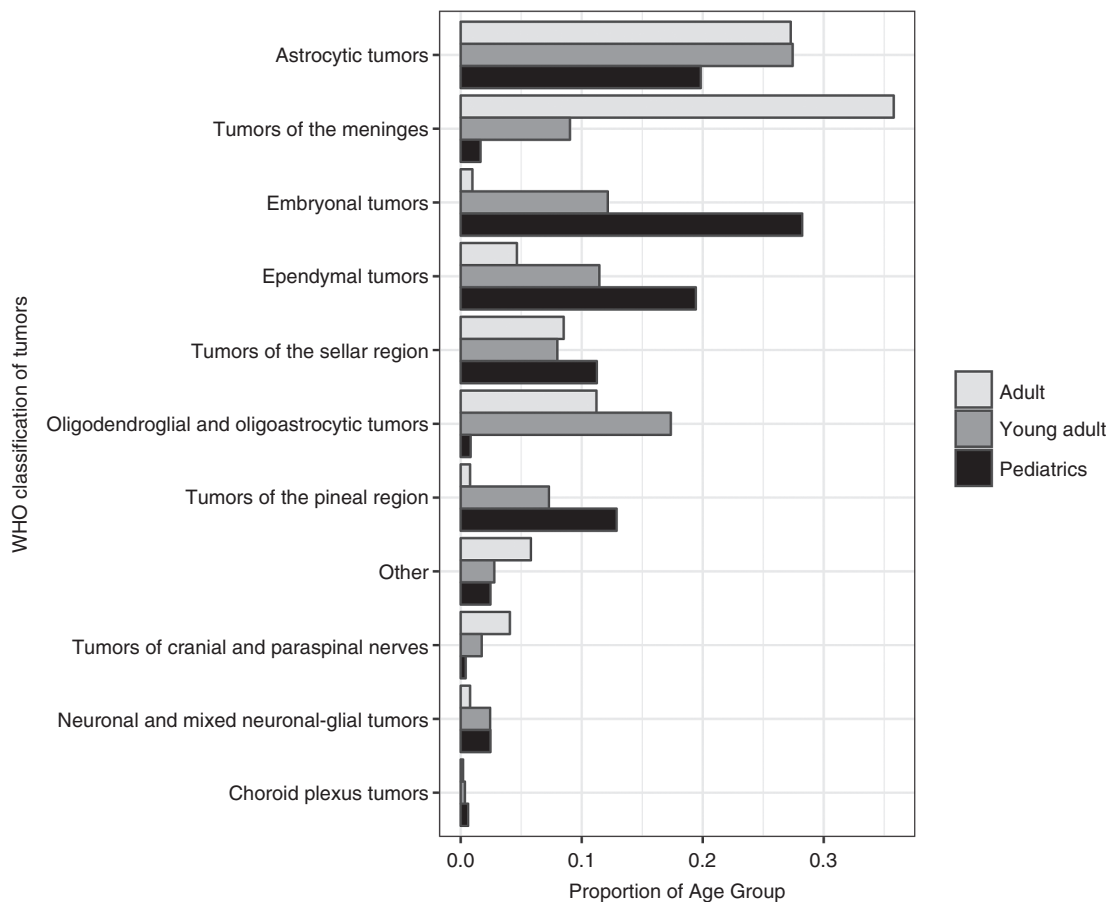


Fig. 1 Grouped bar chart of WHO classification of tumors by pediatric, young adult, and adult age category.

Northwestern Medicine Chicago Proton Center, ProCure PTC–New Jersey, Seattle Cancer Care Alliance PTC, Scripps PTC, Willis-Knighton PTC, Maryland PTC, and the Mayo Clinic Proton Beam Therapy Program (Phoenix, Arizona). Pathology was locally reviewed and categorized according to the 2007 World Health Organization (WHO) classification.⁶

Overall, 37.8% of the patients were pediatric (age ≤ 18 y), 22.2% were young adult (19–40 y), and 39.9% were adult (>40 y). Males were 52.5%; 78.8% were white (6.3% African American, 2.9% Asian, 12.0% other/unknown), and 67.3% were treated at initial diagnosis. The most commonly treated classification of tumors was astrocytic tumors (24.5%), which included glioblastoma multiforme (GBM; $n = 110$; 34.7% of astrocytic tumors), followed by pilocytic astrocytoma ($n = 74$; 23.3%) and WHO grade II astrocytoma ($n = 60$; 18.9%). The majority of GBM patients were adults ($n = 85$), 38 had prior radiation, and 10 received >60 Gy. Two centers treated 61% of GBM patients. The frequency of WHO tumor classification varied over age groups (Fig. 1). A minority of patients had prior radiation (14.2%) or were treated for palliation (1.5%). Craniospinal irradiation was used in 195 patients (15.1%), mainly for pediatric and young adult patients.

To our knowledge, this is the first patterns-of-care study of PT for adult CNS patients. Prior large database³ or survey-based methods⁴ have evaluated pediatric patients only. Our results confirm that embryonal tumors are the most common to be treated with PT among pediatric CNS patients. In contrast, adults were mainly treated for meningeal and astrocytic tumors. These differences between pediatric and adult CNS patients reflect the overall incidence of these tumors in the respective age populations.⁷

Nonetheless, we found that the majority of adult patients treated with PT are young with favorable tumors. This likely reflects the selection of patients that may derive the greatest benefit from reduced dose to the brain and body. However, GBM was the most common astrocytic tumor treated with PT and comprised 8.5% of our cohort. In the Central Brain Tumor Registry of the United States (CBTRUS), GBM comprises 14.9% of primary brain tumors.⁷ Many GBM patients in our study were previously irradiated or likely treated on a clinical trial given that they were treated above standard doses (>60 Gy). Unfortunately, the PCG registry does not capture molecular marker information and/or contemporary CNS patients treated with photon therapy, which would facilitate a comparison of GBM patients treated with protons versus photons. In addition, as PT institutions joined the PCG registry over the study period, we are unable to measure temporal use of PT.

Patients with primary CNS tumors treated with PT are young with relatively favorable tumor types, with few patients treated for aggressive brain tumors such as GBM. This reflects a subset of patients who may derive the greatest benefit from reduction in brain dose. Additional studies are needed to identify which potential factors—physicians, patients, and/or insurance coverage—are the major drivers behind this patient selection.

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Yolanda D. Tseng, William Hartsell, Henry Tsai, Shahed Badiyan, Chiachien J. Wang, Carl Rossi, Rupesh Kotecha, Sujay Vora, Carlos Vargas, Gary Larson, and Lia M. Halasz

Department of Radiation Oncology, University of Washington; SCCA Proton Therapy Center, Seattle, Washington (Y.D.T., L.M.H.); Northwestern Medicine Chicago Proton Center, Warrenville, Illinois (W.H.); ProCure Proton Therapy Center, Somerset, New Jersey (H.T.); University of Maryland, Baltimore, Maryland (S.B.); Willis-Knighton Cancer Center, Department of Radiation Oncology, Shreveport, Louisiana (C.J.W.); California Protons Cancer Therapy Center, San Diego, California (C.R.); Division of Radiation Oncology, Miami Cancer Institute, Baptist Health South Florida, Miami, Florida (R.K.); Mayo Clinic, Phoenix, Arizona (S.V., C.V.); ProCure Proton Therapy Center, Oklahoma City, Oklahoma (G.L.)

Corresponding Author: Dr Yolanda D Tseng, Department of Radiation Oncology, University of Washington, 1959 NE Pacific Street, Box 356043, Seattle, WA 98195 (ydt2@uw.edu).

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