

Automating the Treatment Planning Process for 3D-Conformal Pediatric Craniospinal Irradiation Therapy

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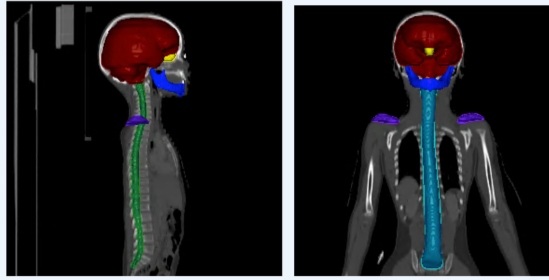
Abstract

Purpose: Pediatric patients with medulloblastoma in LMICs are most treated with 3D conformal photon craniospinal irradiation (CSI), a time-consuming, complex treatment to plan, especially in resource-constrained settings. Therefore, we developed and tested a 3D conformal CSI autoplanning tool for varying patient lengths. **Methods and Materials:** Autocontours were generated with a deep learning model trained:tested (80:20 ratio) on 143 pediatric medulloblastoma CT scans (patient ages, 2-19 years, median=7 years). Using the verified autocontours, the autoplanning tool generated 2 lateral brain fields matched to a single spine field, an extended single spine field, or 2 matched spine fields. Additional spine sub-fields were added to optimize the corresponding dose distribution. Feathering was implemented (yielding 9-12 fields) to give a composite plan. Each planning approach was tested on 6 patients (ages, 3-10 years). A pediatric radiation oncologist assessed clinical acceptability of each autoplan. **Results:** The autocontoured structures' average Dice similarity coefficient ranged from 0.65-0.98. The average V95 for the brain/spinal canal for single, extended, and multi-field spine configurations was 99.9±0.06%/99.9±0.10%, 99.9±0.07%/99.4±0.30%, and 99.9±0.06%/99.4±0.40%, respectively. The average maximum dose across all field configurations to the brainstem, eyes (L/R), lenses (L/R) and spinal cord were 23.7±0.08 Gy, 24.1±0.28 Gy, 13.3±5.27 Gy, 25.5±0.34 Gy, respectively (prescription=23.4 Gy/13 fractions). Of the 18 plans tested, all were scored as clinically acceptable as-is or clinically acceptable with minor, time-efficient edits preferred or required. No plans were scored as clinically unacceptable. **Conclusion:** The autoplanning tool successfully generated pediatric CSI plans for varying patient lengths in 3.50 ± 0.4 minutes on average, indicating potential for an efficient planning aid in resource-constrained settings.

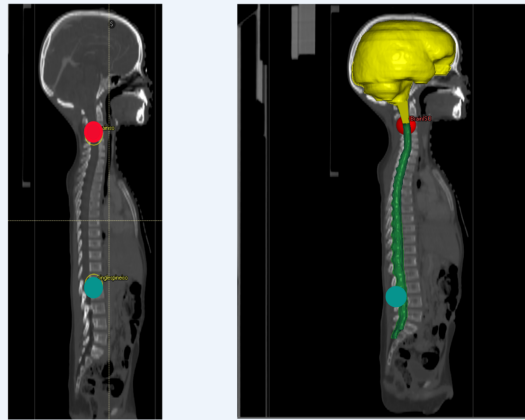
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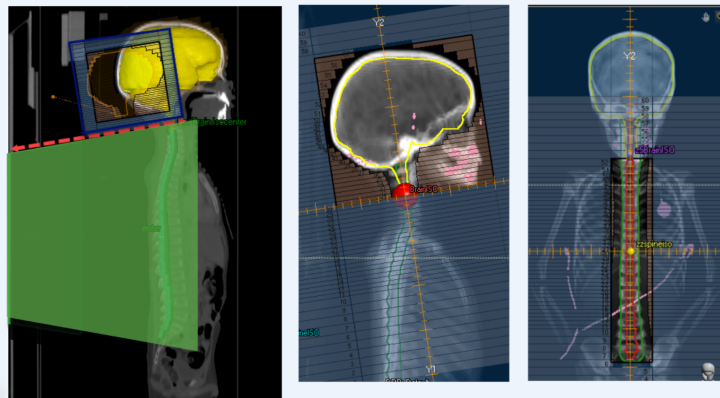
Automatically Contour Structures



Set Isocenters and Define Target Volumes



Generate and Conform Brain and Spine Treatment Fields



Prescribe and Optimize Dose



Feather and Generate Composite Plan

