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# Institution Experience and Long-term outcomes of Craniospinal Irradiation by Modern Image Guided Intensity Modulated Proton Therapy (IMPT-CSI)

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**Objectives**

A detailed and comprehensive audit of the children and adults treated at our tertiary care Proton cancer centre by IMPT-CSI was performed and results analysed

**Methods**

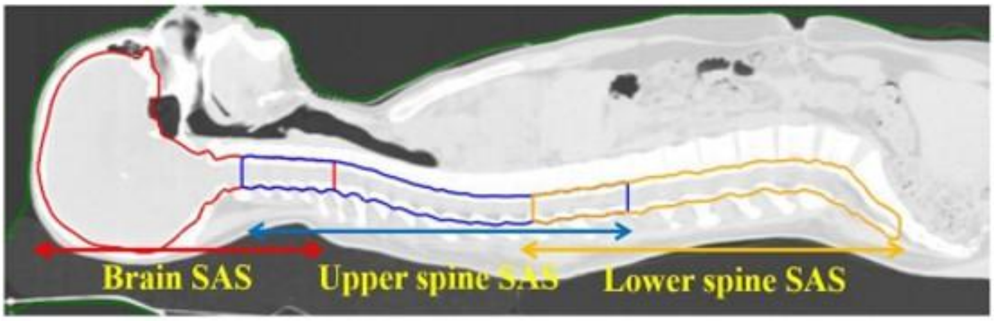
Immobilisation of 172 patients, youngest being aged 1 year old, median age of 14 years (range 1-68yrs), with about 30% of the cohort requiring IMPT under anaesthesia. was performed with base of skull plate inserts/ customized moldcare headrest, HN thermoplastic mask & body vaclock cradle. PTV definition of cranium was as per standard guidelines. PTV definition of the spine for skeletally immature patients was modified from the original whole vertebral body with 5 mm isotropic margin to only the vertebral body with or without spinal nerve root extensions. Two or three spot assignment structures (SAS) were created depending on the height of the patient (fig1). All plans were multifield optimized for 5 mm robustness (cranio-caudal)/2.5% range uncertainty. The treatment set-up was confirmed by both orthogonal radiograph and CBCT. Toxicity was graded as per RTOG criteria and CTCAE v5.0. Survival outcomes and late toxicities were recorded and analysed.

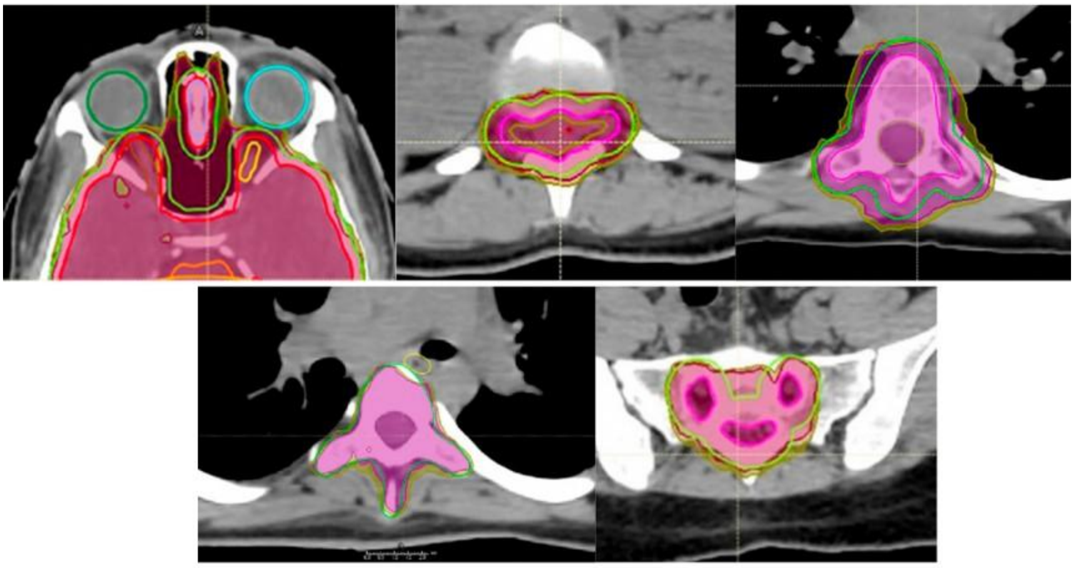
**Results**

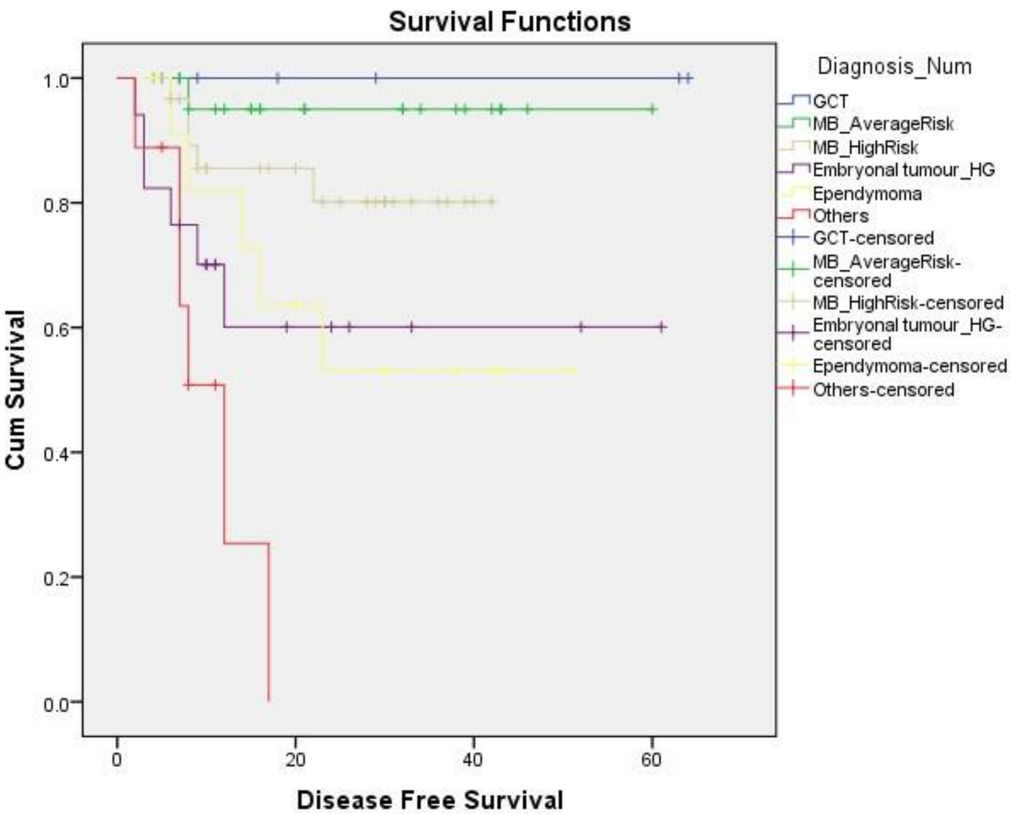
The commonest indication for IMPT_CSI is MB (53%). The dose to the PTV (PTV-CS; length 39.06-79.59 cm) varied from 23.4 to 35 GyRBE. In all patients, the 95% isodose line covered the cribriform plate completely and optic nerves keeping Dmax to the lens <3.9 GyRBE. The median V98% for clinical target volumes and V95% for PTVs of the brain, spine and craniospinal were >97%, with excellent conformity (0.89) and homogeneity (0.07) indices for PTV-CS (fig2). The online patient set-up verification showed translational and rotational deviation within 2 mm and 0.5 in 88-94% and 97% of the cases. Systematic and random error was within 0.90 mm and 1.71 mm in translation and 0.1 and 0.2 in rotation. OTT was well within 45 days in 90%. 40% developed > grade 2 Leucopenia, mostly in children who needed concurrent chemotherapy. Less than 10% developed >grade 3 significant weight loss/ anorexia/ mucositis. At a median follow up of 48 months (range 3–72 months), PFS and OS of the entire cohort was 70% and 84% respectively with PFS in subgroups GCT>MB (AR)>MB (HR)>Emb (HG)>Epen (Rec) = 90%- 44% (p<0.05) (fig3)

**Conclusions**

Long term Outcomes of this large cohort of 172 patients treated with IMPT-CSI showed encouraging dosimetry, toxicity profile and long-term survival







Survival Functions
Diagnosis_Num
GCT
MB_AverageRisk
MB_HighRisk
Embryonal tumour_HG
Ependymoma
Others
GCT-censored
MB_AverageRisk-censored
MB_HighRisk-censored
Embryonal tumour_HG-censored
Ependymoma-censored
Others-censored
Cum Survival
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
Disease Free Survival