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## Two Dimensional (2D) vs Three dimensional (3D) treatment planning in Paediatric Radiation Oncology. Less technology can be acceptable?

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**Introduction:** In our country and others Low Income Countries (LIC) the difficulty to access technology cause delay in Radiotherapy (RT) and decrease survival. Children have their treatments delayed especially if their treatments include 3D plannings. We thought that could be educative to evaluate when 2D plannings could be used safely in paediatric radiation oncology cases. During a project supported by IAEA –PRON- Optimization of radiotherapy in low resource settings: pediatric cancer patients”–we compared 2D and 3D plannings in patients that had agreed to participate and/or performed also 2D planning for any reason. The goal was compare inside of the same patient the two different modalities 2D vs 3D to detect in which situations would be acceptable to perform a 2D planning.

**Methodology:** All patients were planned at the AccuityVarian digital simulator using planar RX (2D). The physician defined fields and protections based in bone marks and/or Computed Tomography (CT), magnetic resonance image (MRI) to evaluate the target, margins and OAR. All the 2D plannings were performed first. After the procedure at the simulator, all the patients were also submitted to CT planning and all the structures (GTV, CTV, PTV and OAR) were contoured by the same physician in the TPS. The patients were then planned to 3D treatment. They were planned using a TPS Eclipse Varian to calculate the 2D and 3D plannings. The fields and MLCS defined by the physician at the Simulator were copied to the CT of the patients and the 2D planning reconstructed and calculated in TPS. The comparison of the 2 plannings (2D vs 3D) were performed at the TPS and the doses to the targets and OARs analyzed using dose volume histogram data. Statistic analysis were done using Wilcoxon Non parametric Test. BioEstat 5.0 software -  $p \leq 0.05$ .

**Results:** We studied 28 patients, 15 male, 13 female, (18 months to 21 years old), mean age 8,5 years. We had different cases and sites: Cranio-Spine Irradiation (CSI)(4) leukemia (Brain to C2-3 irradiation) (3); lymphoma (2) , wilm’s tumor(5)(whole abdominal irradiation (WAI+ boost) (3), Whole lung irradiation WLI (2); combined sites (1); Soft tissue tumors (STT) (6): face (2) extremities (2), thorax (2), combined sites (2); Central Nervous System(CNS) tumors (8). We observed that: In CSI and Leukemia cases 2/7 (28,5%) of cases the cribriform plate was not well covered 70%vol with dose prescription, but the difference in coverage were not significant  $p = 0,06$ . The dose to the lens and eyes were increased in 3D plannings. The dose to the caudal extent of thecal sac was efficient in all the four patients. The dose to the kidneys were significantly reduced with 3D planning (volume 23Gy –decreased 40%). The coverage of CTV and PTV were not statistically significant different,  $p = 0,25$ . Lymphomas cases plannings –the dose to the GTV, CTV and PTV were similar however the dose to the lungs was increased in 2D plannings –V20 –50%, V15 30% V5 15%. Wilm’s tumor cases plannings to WLI and WAI followed by boost showed no difference in terms of target coverage between 2D vs 3D planning. The OAR doses were lower with 3D but not significantly different  $p = 0,056$ . Soft tissue tumor cases (STT) –STT face- The dose to the GTV were unsatisfactory, in general 20% lower than 3D planning. The doses to the OAR were in general increased with 2D in special optic nerves and optic chiasm. Dose to CTV and PTV was unacceptable 30 to 40% lower than 3D. The coverage of PTV and CTV was statistically significant better to 3D  $p = 0.034$ . STTs extremities –The coverage of GTV and CTV were acceptable in extremities but the PTV had lower doses 80% vs 93% coverage. The STT thorax planning showed the 20 to 30% lower coverage to CTV and PTV in and the OAR (heart and lung) had increased doses with 2D. CNS tumors cases plannings showed the dose to GTV were lower with 2D but not significant  $p = 0,64$  mean dose to CTV and PTV were significantly

better to 3D  $p = 0,04$  and  $p = 0,02$  respectively. Significant protection to optic chiasm was observed with 3D. Brain, temporal lobe dose were not significant different.

Conclusions: Based in this cases. 2D plannings of WLI, WAI in Wilm's tumor and STT of extremities are safe and acceptable, CSI and leukemia 2D plannings can be done relatively safe but with care to cribriform plate coverture. Plannings of STT face, STT thorax and lymphomas were unacceptable. The worst situation was the CNS tumors to perform 2D plannings.

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