Cardiac substructures dose sparing in pediatric Hodgkin’s lymphoma

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Introduction

Pediatric Hodgkin’s Lymphoma (PHL) survivors represent a group of patients (pt) at high risk for clinical and subclinical cardiovascular (CV) disease. The incidence of CV events increases over time from the diagnosis. Both chemotherapy and radiotherapy (RT) are responsible for cardiotoxicity. Often RT target is located near critical cardiac substructures (CS) such as origin of coronary arteries and cardiac valves. Thus, became important to assess the risk of long-term CV complications after therapy. In this study, we analyzed the dose received by different CS using intensity-modulated radiation therapy (IMRT) “butterfly” technique (BT)

Methods

Four PHL pt (mean age 13±4) with stage II-IV and mediastinal bulky disease were treated with involved-site radiotherapy (IS-RT). Treatment plans were performed with TPS Pinnacle, planning a total dose range from: 14,4Gy in 8 fractions (fr) for pt enrolled in AIEOP LH 2004 protocol, and 28.8Gy in 16 fr for pt enrolled in Euronet PHL C2 protocol. We use Contrast CT (cCT) for segmentation of CS, than we performed deformable image registration (DIR) in MIM Software to adapt organs at risk between cCT and Simulation CT. The following CS were contoured: right and left atrium, right and left ventricle, aortic, pulmonary, mitral and tricuspid valves, left main, left anterior descending, left circumflex and right coronary arteries. IMRT plans were generated using 5 co-planar beams (3 anterior 330°- 0°- 30° and 2 posterior 160°-210°) BT. We analyzed PTV coverage (V95% -percentage volume receiving 95% of prescription dose-), and doses to CS (Dmax, Dmean). Furthermore, we performed a CS dosimetry comparison between IMRT and 3DCRT plan

Results

Dose sparing of CS, especially origin of coronary arteries and cardiac valves, is achievable with IMRT BT. In in case of overlap with target, priority is assigned to target coverage. We met IMRT PTV coverage V95% =97% vs 81,09% 3DCRT (pvalue 0.04). Whole heart Dmean and Dmax were respectively 5,18Gy (±3,37) and 19,62Gy (±5,47) with IMRT vs 4,04Gy (±2,25) and 19,67Gy (±4,85) with 3DCRT plan. The lowest Dmean was achieved for aortic and pulmonic valves and for left main, left circumflex and right coronary artery with IMRT BT plan

Conclusion

Mediastinal radiation dose is the most important risk factor for the appearance of late CV disease in PHL. Lower radiation doses for current protocols and IMRT BT treatment planning increase dose sparing for CS so that further reduction of cardiac late effects may be expected

Acknowledgment
Authors decleare no conflict of interest