Purpose:

A treatment planning study was performed to compare fixed field IMRT, coplanar and noncoplanar VMAT.

Methods:

Treatment planning CT scans of three lung cancer patients with small (2244cc), medium (2845cc) and large (3531cc) lungs were used to create simulated patient cases. For each simulated patient, three spherical tumors (GTV) of varying diameters: 1, 3, 5 cm were contoured onto lung CT scans. The ITV was set as GTV+2 cm and the PTV was set as ITV+1 cm. The location of the tumor was set in the right middle lobe of lung. For each patient scenario, the IMRT (nine static fields), single coplanar arc VMAT and 5 noncoplanar arcs VMAT treatment plans were generated using Pinnacle treatment planning system. The arcs of noncoplanar VMAT were set at -30o (clockwise and counterclockwise), 0o and 30o (clockwise and counterclockwise). The treatment plans were evaluated by calculation of V100%, V80%, V50% and V20%, DVH of dose constrain rings (DCR) at PTV+1cm, +2cm, +3cm, +4cm and Paddick Conformity Index (CI: 0-1 best) and Gradient Index (GI: the smaller the better).

Results:

The V100% and V80% were similar for all the plans but the V50% and V20% were the largest for IMRT, and the smallest for noncoplanar VMAT. The noncoplanar VMAT had larger V<20 but smaller V>20 for all the DCRs comparing to the other two plans. The CI of noncoplanar VMAT was slightly larger than the other two plans. The GI was the smallest for noncoplanar VMAT and the largest for IMRT for all the simulation scenarios.

Conclusions:

The noncoplanar VMAT consistently provides high dose conformity to the target and low dose to healthy tissue. The noncoplanar VMAT has larger low dose volume while smaller high dose volume comparing to IMRT and coplanar VMAT.
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