Dynamic Conformal Arc-Hybrid Technique for Standard Fractionation used for Multiple Treatment Sites

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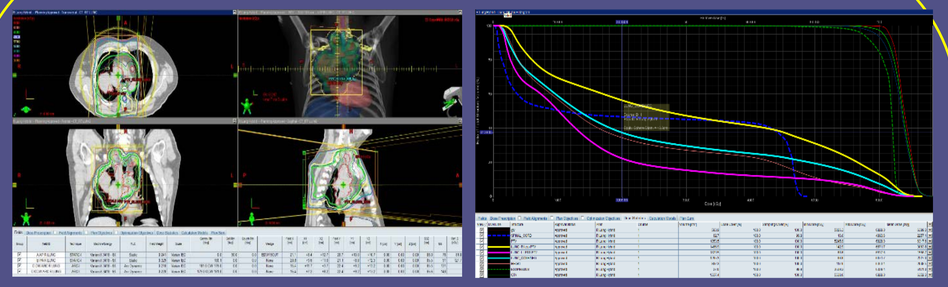
Purpose

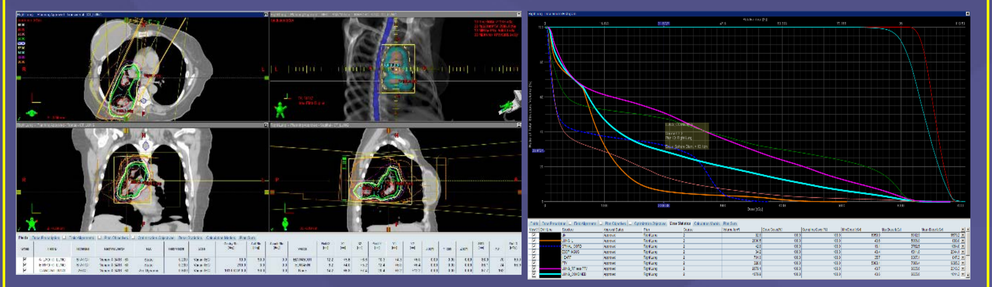
The objective of this study was to evaluate Dynamic Conformal Arc (DCA)-Hybrid techniques to improve dose conformality for target volume while sparing local OARs to achieve clinically acceptable results. Publications have reported hybrid technique approaches for hypofractionated SRS for intracranial disease as well as hypofractionated SBRT for lung cancers. This study reports on standard fractionation for several anatomical regions utilizing a DCA-Hybrid technique.

Methods

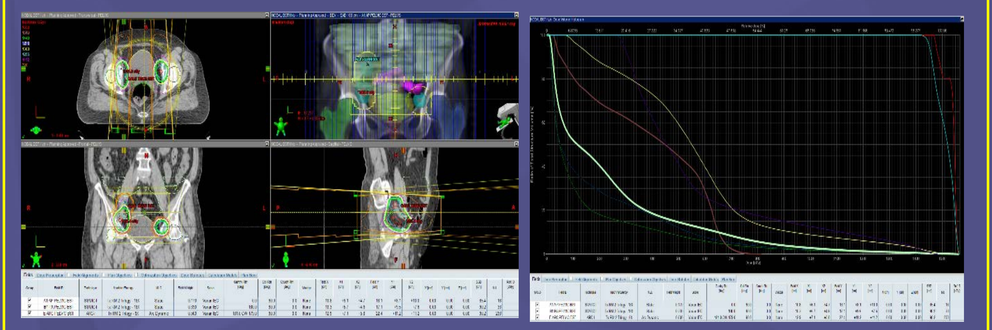
Treatment plans for this study were generated using DCA in conjunction with a static 2-field approach. No inverse optimization was necessary. The most commonly used field/arc configuration was an AP/PA arrangement and a single DCA. Varian Eclipse Version 11 was utilized. Optimal 3D fields were generated and MLCs were conformed to the target. Field weighting and selection of an appropriate reference point for normalization were critical to achieve appropriate dose distribution for the final acceptable plan. Sites found to benefit from DCA-Hybrid planning were lung, distal esophagus, stomach, and pelvic nodes.



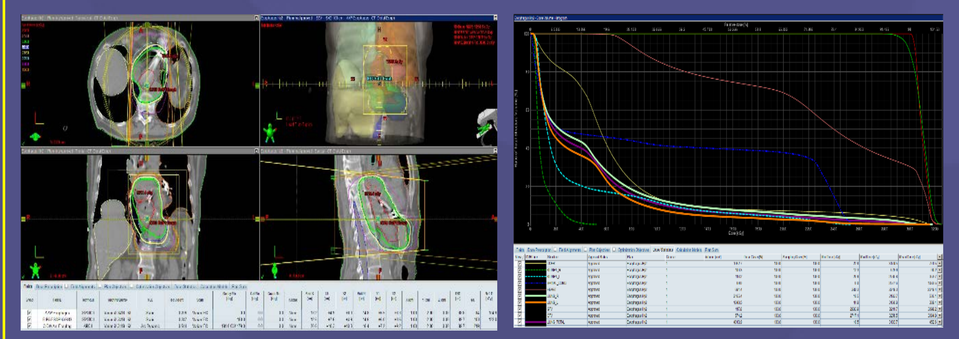
Case 1: Non-small cell Lung Cancer, treating the right upper lung, right paratracheal nodes, and supraclavicular nodes. Prescription is 60Gy in 30 fractions using 6X energy. Planned using DCA-Hybrid (AP/PA static fields with DCA-CW/CCW). The arc fields were generated from the “fit and shield” option for conforming the MLC. Notice on the DVH the lung V20 is at 37% and the spinal cord dose is below 50Gy



Case 2: Adenocarcinoma of the lung, treating right lower lung and right hilum. Prescription is 60Gy in 30 fractions. Planned using DCA-Hybrid (LAO/RPO static fields with CW Arc). The plan is scaled to the 95% isodose line to maintain target coverage. Notice on the DVH the lung V20 is at 28% and the spinal cord dose is below 40Gy



Case 3: Endometroid Carcinoma, treating the pelvis to 45Gy in 25 fractions followed by bilateral nodal boost to 14.4Gy in 8 fractions. Total prescription dose is 59.4Gy in 33 fractions. Planned the nodal boost using DCA-Hybrid (AP/PA static fields with CW Arc). Notice the collimator is rotated to 90 for dose conformality. The plan is scaled to the 98% isodose line to maintain target coverage



Case 4: Adenocarcinoma of the distal esophagus, treating distal esophagus to palliative doses. Prescription is 30Gy in 10 fractions. Planned using DCA-Hybrid (AP/PA static fields with CW Arc). The plan is scaled to the 98% isodose line to maintain target coverage. Notice on the DVH the spinal cord dose is below prescription dose as well as low dose to surrounding OARs

RESULTS

The DCA-Hybrid technique resulted in advantages in plan quality with OAR sparing and PTV coverage. Benefits when compared to conventional 3D and/or IMRT/VMAT were efficient planning processes and improved efficiency in delivery. Workflow improvements within the clinic were also appreciated. A reduction in hot spots compared to 3D planning occurred for several of the cases. A decrease in MU compared to inverse planning techniques was seen in many cases.DCA-Hybrid planning for Case 1 (bulky lung cancer with close proximity to the spinal cord) achieved lung V20 $\leq$ 37% and met cord tolerance below 50Gy. Unique to this case was the use of the Eclipse “fit-and-shield” option. Eclipse generates an opposing arc from the initial arc with blocking of the spinal cord throughout both arcs while maintaining the defined MLC conformation to the target. In case 2 (lung cancer case with opposed oblique fields and DCA-partial arc) the results included reduction to contralateral lung V20 values, reduction of V30 values for the combined lung, and the spinal cord was kept to less than 40Gy.

Conclusion:

DCA-Hybrid techniques have been shown to be a time effective technique utilizing a 2-field, 3D arrangement with a single DCA. The ease and simplicity of this planning and delivery technique has a potential to be superior to other techniques while achieving dose conformality and OAR avoidance. DCA-Hybrid technique is a viable option for conformal dose delivery when IMRT/VMAT inverse optimization techniques cannot be utilized due to patient insurance status. This technique is a reliable and efficient method with certain clinical cases benefiting with clinically acceptable target conformality, OAR avoidance, reduced Mus, and overall time the patient could be on the treatment table.

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