Multi-Isocenter Breast Planning on Halcyon® Treatment System

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OBJECTIVE

To evaluate multi-isocenter planning technique for breast/chestwall with nodal involvement on Halcyon™ treatment system

MATERIALS AND METHODS

Patients requiring left sided breast and nodal treatment underwent simulation in the supine position on a breast board with arms overhead. A Deep inspiration breath hold (DIBH) scan was performed for left sided breast planning to keep the heart out of the treatment field. Right sided breast ware planned on a free-breathing scan. Varian Eclipse™ treatment planning software version 15.6 was utilized for planning.

Multi-isocenter technique with auto-feathering is used to create treatment plans. This technique is utilized to overcome the field size limitation of 28cm superior-inferiorly on Halcyon with mono-isocenter. By placing two isocenters within 8cm in the sup-inf direction, Halcyon is able to treat up to 36cm without requiring re-setup or re-imaging from one isocenter to the other. In addition, a separate imaging isocenter can be set differently from the two treatment Isocenters to facilitate capturing regions of interest for online IGRT localization using kV CBCT.

All 3 isocenters (two treatment isocenters and one imaging isocenter) are all set in one plan, with only sup-inf positions being different. One isocenter is set to be used to plan SCLAV region, upper breast, and nodal region while another treatment isocenter set to a maximum of 8cm below to treat the inferior breast region. Another imaging isocenter is placed in between the two planning isocenters to enable IGRT using the entire supraclavicular region and breast treatment volumes.

Plans using different isocenters are planned separately. For the SCLAV plan a collimator of 90 degrees is used to allow for finer resolution when editing fluence at the SCLAV-tangential beams matchline. For the breast plan, typical tangential beam arrangements are used for the upper (sharing the same isocenter as SCLAV) and lower (isocenter up to 8cm inferior to the SCLAV isocenter) breast portion of the plan. The tangential breast fields are then planned similarly to electronic compensation (ECOMP) technique, where the fluence from each field is dynamically adjusted to provide homogeneous dose distribution within the irradiated volume, defined by the physician. Following both plans being acceptable, the plans are then combined into a single plan and further adjusted to meet constraints at the matchline area. For plans on Halcyon, no bolus is utilized.

Prescriptions for the plans are 5040cGy with 180cGy daily over 28 fractions or 5000cGy with 200cGy daily over 25 fractions. Treatment set up is verified with daily kvCBCT imaging.

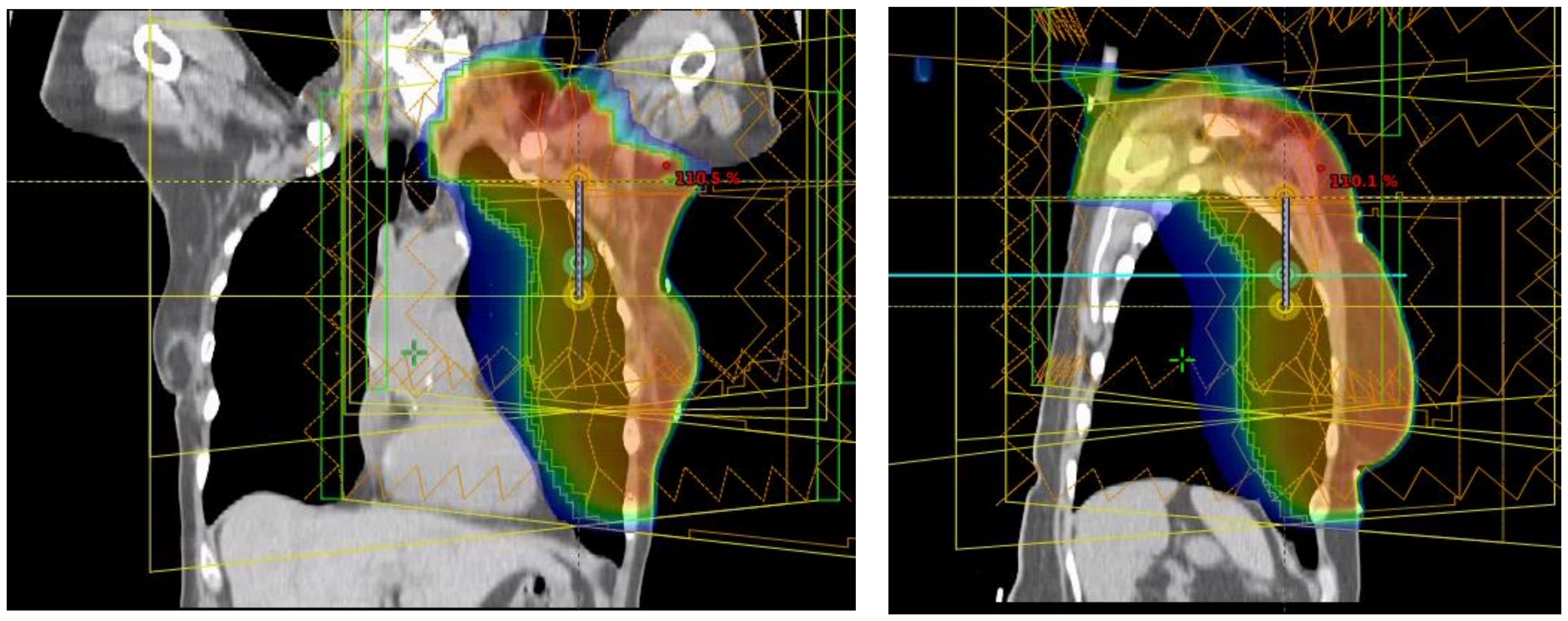

Figure 1: Coronal / sagittal isodoses for multi-isocenter plan on left chestwall patient

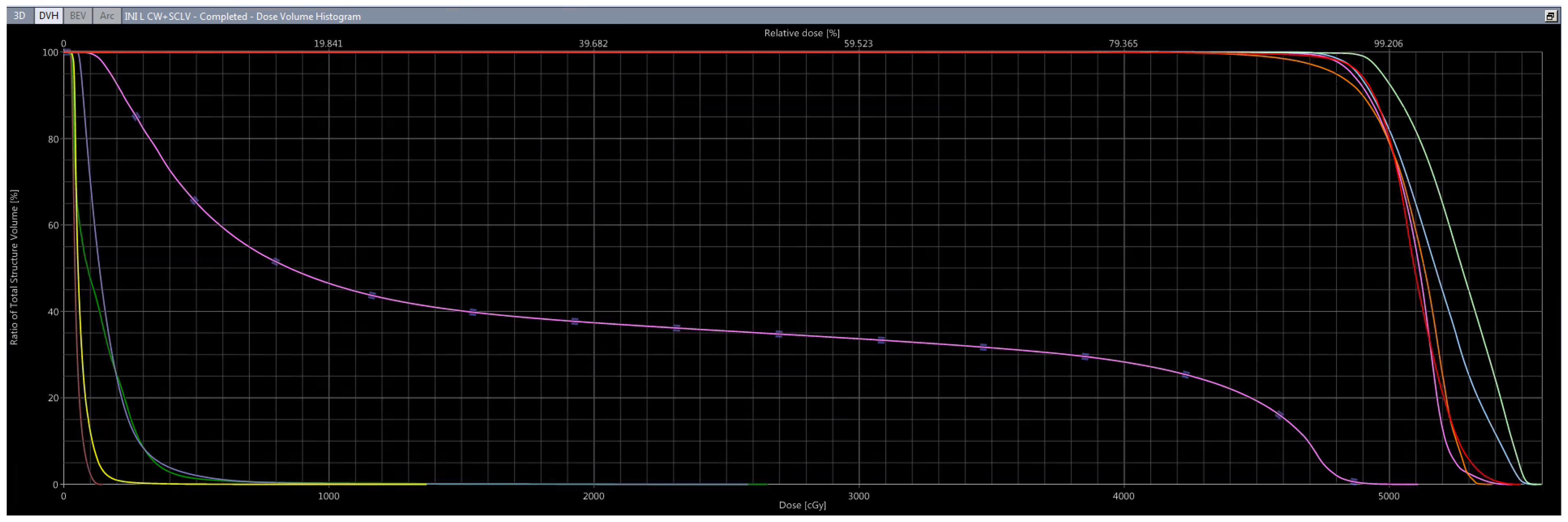

Figure 2: DVH results of left chestwall patient. All the PTVs' DVH on the far right meet objectives. The pink DVH line represents left lung.

RESULTS

Halcyon plans are typically able to achieve 95% coverage of PTV's for breast, SCLAV, axillary nodes, and IMN target volumes by 95% of the prescription dose. 105% of prescription dose is minimized to the breast volume with the goal of keeping it less than 10%. The goal mean dose to the heart is 300cGy. Lung constraints are V20Gy less than 30% for ipsilateral lung and V5Gy being below 10% for contralateral lung. The overall matchline hotspot goal is 0.03cc less than 110% of prescription dose.

CONCLUSIONS

We successfully implemented a mult-isocenter planning strategy for breast/chestwall irradiation with nodal involvement using Halcyon platform utilizing automatic dual-isocenter delivery with a single imaging. Further studies can be done to evaluate plan differences using multi-isocenter technique on Halcyon vs. mono-isocenter on a C-arm Linac. Plan quality, setup, and treatment time can further be evaluated.

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