Application of a Hybrid Rapid Arc/3D Radiotherapy Technique to Reduce Toxicity to Lungs
Rafick Margusian, CMD, MS, Lisa Maslack, CMD
Kaiser Permanente, Radiation Oncology, Rancho Cordova, California, USA

Abstract
To test and evaluate plan quality and reduce dose to critical organs by using a “Hybrid Planning Technique” instead of 3D CRT and RapidArc plans alone.

Introduction
• It is challenging to reduce the volume of lung treated to low doses while keeping the heart dose low and getting a conformal plan for Lung, Lung SBRT, Esophageal and Breast patients when using a RapidArc or 3D CRT technique alone.
• 3D CRT and Conformal Arc plans avoid low dose to lungs and surrounding tissues. RapidArc plans increase the conformity and reduce the high dose to lung and surrounding tissues. Therefore, Hybrid plans should create a balanced plan with greater conformity and lower dose to critical organs specifically lungs.
• We learned that in order to avoid large hot spots on RapidArc plans, we should have enough margin around the PTV in the 3D CRT plan. If you minimize the margin of the PTV in the 3D CRT plan, it forces the RapidArc plan to push the dose to the under dosed areas to give uniform dose to the PTV.
• If the lower dose to the Lungs are above tolerance (V500 cGy should be <65% per NCCN guidelines), increasing the percentage of the 3D CRT plan will help to reduce the lower dose to the lungs.
• For Eclipse users, the 3D CRT plan should be used as a base plan. (Image 2)

Methods and Materials
Treatment plans were analyzed for 19 randomly selected patients (10 Lung, 3 Esophagus, 3 Breast, and 3 SBRT Lung). 3D CRT, RapidArc and Hybrid plans were generated for each patient. For Lung and Esophagus cases, Hybrid planning techniques were generated using 40%-48% of prescribed dose with 3D CRT technique (75%-80% for Breast tangents) and a RapidArc plan by using two half arcs on the PTV side for the remaining percentage. For Lung SBRT cases, Hybrid planning techniques were generated using 70% Dynamic Conformal Arc and 30% RapidArc.

Results
• Hybrid plans treated significantly smaller lung volumes with low doses compared to RapidArc or 3D CRT plans while maintaining the PTV coverage for all plans.
• The maximum dose was much lower in the Hybrid plans in comparison with both RapidArc and 3D CRT plans.
• The average MU for Hybrid plans was higher than 3D CRT but lower than RapidArc plans.
• The lower doses to lung was lower in 3D CRT plans but the Hybrid plan makes a significant reduction on the high dose region of all the critical organs.
Please review Table 1&2 for more comparison.

Conclusions
• It is challenging to reduce the volume of lung treated to low doses while keeping the heart dose low and getting a conformal plan for Lung, Lung SBRT, Esophageal and Breast patients when using a RapidArc or 3D CRT technique alone.
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Contact
Rafick Margusian, MS.CMD, Lisa Maslack, CMD
Kaiser Permanente
Email: Rafick.Margusian@kp.org
Lisa.A.Maslack@kp.org
Phone: 916-631-2730 Ex 2742/2741

References
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