Variable Dose Rate Dynamic Conformal Arc Therapy (DCAT) for SABR Lung: From static fields to dynamic arcs using Monaco 5.10

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Introduction and Contents

- Historic treatment of SABR lung cases at GCWA
- What is DCAT and what does Monaco offer
- Rationale for change
- Comparisons of plans between DCAT and Static fields
- Treatment deliver times
- Treatment day imaging
Historic treatment planning

- An ITV is contoured on a 4DCT and max intensity projection
- An isotropic growth of 3-5mm for PTV growth
- Planning on Mean Intensity Projection using Pinnacle
- 11 static fields, optimised collimator rotations, forward planned
- Elekta Axesse linac with a beam modulator head and flat 6MV
Patient treatment day

• Slow 3 minute CBCT using Elekta XVI
• Dual registration to localiser scan of the 4DCT
• Check bony anatomy to ensure correct level against the spine
• Soft tissue match to check that the target is visible within the PTV contour and motion doesn’t extend outside it (RO present)
• Look for less than 5mm difference between the registration otherwise check patient set up
• Complete any table moves remotely
• Deliver 5-6 beams
• Repeat the CBCT and registration. Move if required.
• Deliver the rest of the beams
Potential to have the “simplicity” of 3D conformal treatments, with the conformity and treatment time gains associated with arc therapies, all calculated using Monte Carlo.
Treatment plan comparisons

- 10 historic SABR lung patients of GCWA
- All prescribed 48Gy in 4 fractions
- Planned DCAT in Monaco and 3D conformal in Pinnacle
- Pinnacle plans were imported into Monaco and re-calculated using the Monaco beam model
- All calculations were completed on a 0.2cm dose grid with an uncertainty of 0.5% per plan
- All plans were renormalised to have 95% of PTV covered by the prescription dose of 48Gy
GTV and PTV coverage

- Greater coverage, more homogenous, reduced median dose
Surround dose fall off

- Comparable dosimetry at 100% and 50% isodose line
• 105% isodose more contained, lung V20 is comparable
How does this look in the TPS

- 11 field – DCAT. (Red = 11 field hotter, ±10%)
How does this look in the TPS

- 11 field – DCAT. (Red = 11 field hotter, ±10%)
Time to deliver to phantom

- For the previous plans load the patient in Mosaiq.
- Start a timer and deliver the plan to air
- Static – deliver beam, ASU, deliver. Repeat
- DCAT – Beam on and time
- In addition the time between the 1st CBCT completion and mid treatment CBCT initiation for 194 historic fractions were assessed

<table>
<thead>
<tr>
<th>Method</th>
<th>Mean Time to deliver</th>
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<tbody>
<tr>
<td>3D conformal (6 beams)</td>
<td>5 mins 16 seconds</td>
</tr>
<tr>
<td>3D conformal (11 beams)</td>
<td>9 mins 52 seconds</td>
</tr>
<tr>
<td>DCAT</td>
<td>3 mins 54 seconds</td>
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<tr>
<td>3D time to CBCT clinical (n=194)</td>
<td>13 mins 35 seconds</td>
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Can we remove mid treatment CBCT?

- On review of 194 fractions

<table>
<thead>
<tr>
<th>Movement Over</th>
<th>% of Patients (n=194)</th>
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<tbody>
<tr>
<td>1mm</td>
<td>75.6%</td>
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<tr>
<td>2mm</td>
<td>46.3%</td>
</tr>
<tr>
<td>3mm</td>
<td>28.8%</td>
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<tr>
<td>≥4mm</td>
<td>15.5%</td>
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- Currently experience 85% of patients moving less than 3mm
- Decision was made to remove CBCT
Summary

- Over the patient cohort tested
- DCAT has higher near minimum doses, lower median dose and lower maximum doses
- This results in a more homogeneous dose distribution
- The surround dose and OAR doses are very comparable in most cases
- The treatment can be delivered in less than half the time
- Treatment appointment slots have been reduced from 30mins to 15mins which is preferred by the patients
- Decided to drop a mid treatment CBCT, reducing imaging dose and further reducing treatment time
Thank you for listening
Any questions?