Evaluating automated contour propagation for estimating tumour shrinkage in small-cell lung cancer patients treated with chemo-radiotherapy

A McWilliam1,2, A Green3, J Khalifa3, T Merchant2, N O’Conner4, C Faiivre-Finn1,2, M van Herk1,2

1 Division of Clinical Cancer Science, Faculty of Biology, Medicine and Health, The University of Manchester, UK; 2 The Christie NHS Foundation Trust, Manchester; 3 Department of Radiation Oncology, Institut Universitaire du Cancer de Toulouse; 4 Elekta Maryland Heights

Introduction
The clinical relevance of tumour shrinkage during thoracic radiotherapy remains unknown with studies showing conflicting results whether shrinkage predicts outcome. Previous work has relied on manual contouring on cone beam CT (CBCT). To enable large scale analysis, automated methods for contour propagation and quantification of tumour shrinkage are essential.

Method
- 20 small-cell lung cancer patients treated with chemo-radiotherapy
- Manual contouring of the GTV on all CBCTs
- Automatic propagation of the GTV was performed (ADMIRE, Research v1.13, Elekta AB, Stockholm, Sweden). (Figure 1)
- Median Distance to Agreement (mDTA) was calculated between contours to assess accuracy
- Differences in volumes (manual versus automatic) were assessed using a Bland-Altman plot (Figure 2)
- Relative percentage change was calculated at each time-point and fitted using linear regression to assess shrinkage (Figure 3, 4)

Results
ADMIRE successfully propagated GTV contours across all CBCTs. Concordance between the manual and propagated contours showed an unsigned mDTA of 3mm across all CBCT. Results were worse for GTV contours overlapping with the mediastinum

Conclusion
The results show that automatic contour propagation performance is acceptable for use in wider research studies. There are differences between the manual and propagated contours, with the clinician estimated a larger rate of tumour shrinkage, which is suggestive of an observer bias. We will now apply this technique to investigate tumour shrinkage and outcome in the CONVERT trial patients.