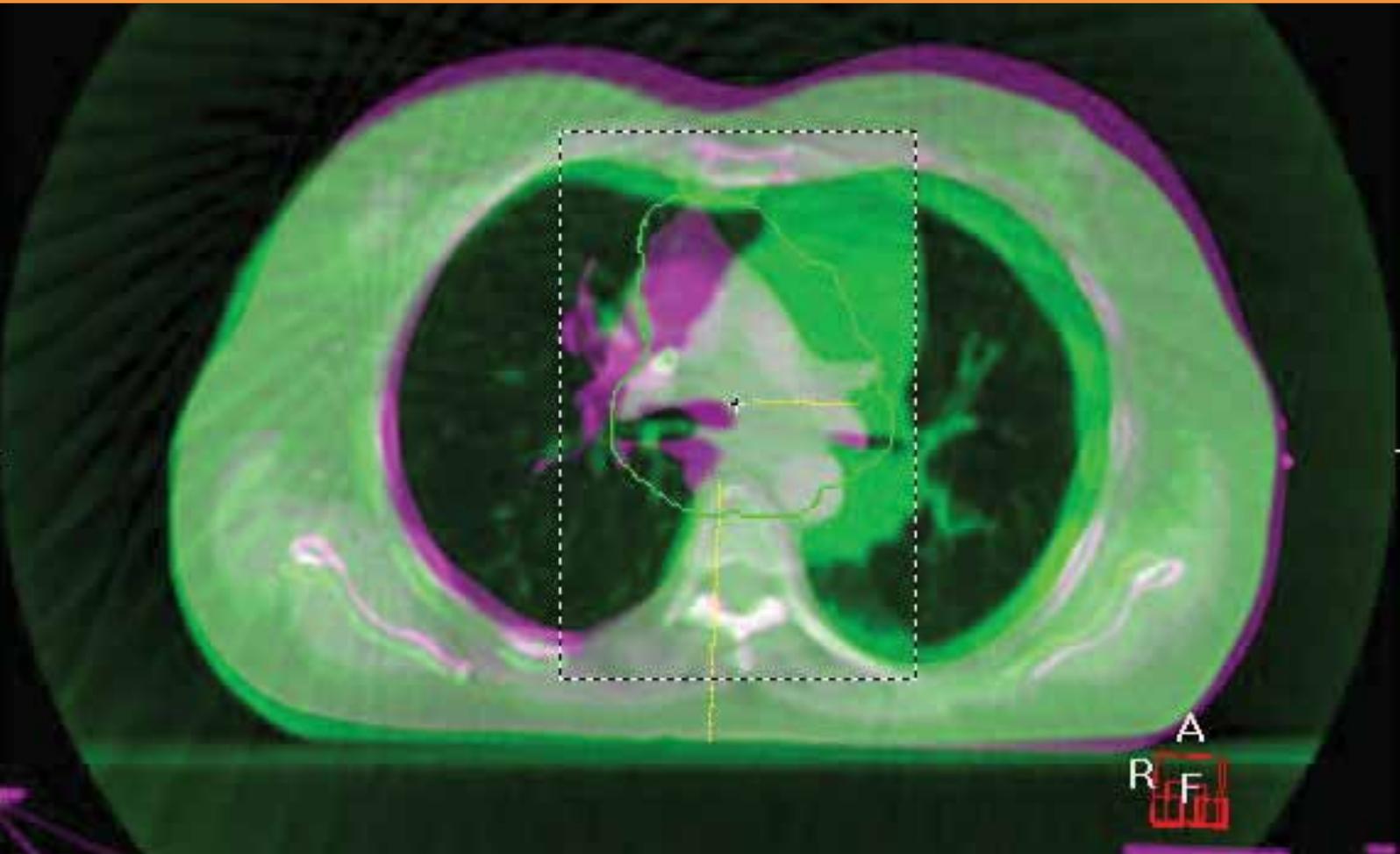


## Identification of a collapsed lung during radiotherapy using Elekta Synergy® VolumeView



INSTITUTION:	Royal Marsden NHS Foundation Trust, Sutton UK
PATIENT:	59-year-old female
DIAGNOSIS:	Small cell lung cancer with mediastinal invasion
PLAN:	Phase I 10MV parallel pair – phase II four-field conformal 6MV + 10MV
IMAGE GUIDANCE:	Elekta VolumeView™
POSITIONING:	iViewGT™ portal imaging
TREATMENT:	Total dose phase I and II 40Gy in 15 fractions over three weeks



# Identification of a collapsed lung during radiotherapy using Elekta Synergy® Volume View™

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## Introduction

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We describe the identification during radiotherapy (RT) of a collapsed lung, and subsequent re-inflation of the lung in a patient with small cell lung cancer, as seen with cone beam CT using Elekta Synergy®. Treatment radiographers identified the initial collapsed lung and were alert to further changes. The patients' treatment was regularly verified with Elekta Synergy throughout the course of radiotherapy, with particular attention paid to the soft tissue anatomy easily visualized with Elekta Synergy. In conclusion, Elekta Synergy provides more than just bony anatomy definition. Consideration needs to be paid to who is appropriately trained to make decisions based on soft tissue analysis, and in future to adaptive therapy.

## Patient history

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A 59-year-old female presented with an 18 month history of an irritating cough, hoarse voice, shortness of breath on exertion and weight loss of 1 1/2 stones in six months. Subsequently she was diagnosed with a small cell lung carcinoma with mediastinal invasion. The patient was an ex-smoker, 30-a-day for 40 years, prior to giving up three years ago.

After four cycles of Carboplatin and Etoposide disease progression was evident on CT, and the patient proceeded immediately for radical RT and chemotherapy was stopped. Radical treatment usually takes approx 10 to 14 days from referral to start of treatment, but on this occasion the patient was required to start treatment within a week. A National Holiday weekend made the time-scales even more challenging. The decision was made to commence with a parallel pair and then move to a conformal plan as soon as possible.

The patient was reviewed the day after the planning scan (five days from decision to treat) and the left main bronchus was now virtually obliterated. The patient was breathless although not significantly so.

## Treatment plan

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Total dose (phase 1 and 2) 40Gy 15 fractions over 3 weeks prescribed to 100% – treatment planning was carried out using Philips Pinnacle® (phase 1, parallel pair 10MV; phase 2, four-field conformal plan 6 + 10MV). The patient was treated on Elekta Synergy with Beam Modulator™ and MOSAIQ record-and-verify. Departmental routine verification for parallel pair treatment is MV electronic portal imaging (EPI) of the treatment field. The image from fraction 1 was not adequate to confirm the isocenter position, although the field shape was verified using iViewGT™ (see figure 1). The exposure was amended and the image repeated at the next fraction. The MV EPI was not conclusive at fraction 2, and showed distinct shadowing on the left side of field (see figure 2). The radiographers asked for advice and it was recommended to use Elekta Synergy VolumeView™ at the next fraction. At the third fraction the acquired images could not be matched to the reference planning CT using soft tissue, although bony anatomy was within tolerance, suggestive of a collapsed lung since CT (see figure 3). The images were reviewed by a clinical oncologist and a repeat VolumeView at the next fraction was requested (see figure 4). The lung had now re-inflated and was matched with the reference image. After four fractions the conformal plan was available and used for subsequent treatments.

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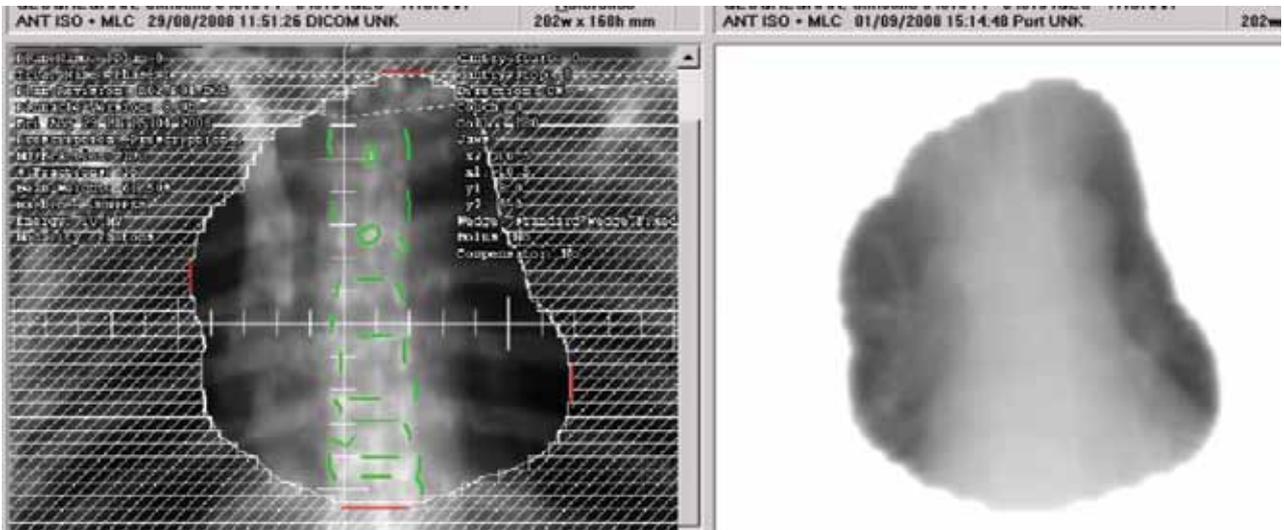


Figure 1: EPI on iViewGT™ – fraction 1 compared to DRR from planning scan.

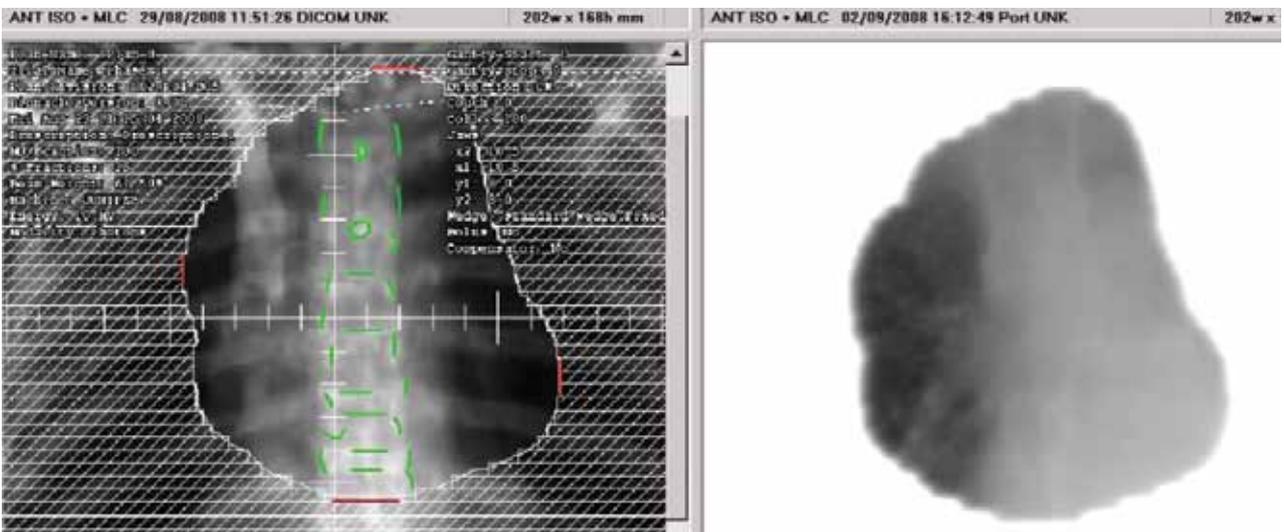


Figure 2: EPI on iViewGT™ – fraction 2 compared to DRR from planning scan, EPI shows lung looking more dense laterally.

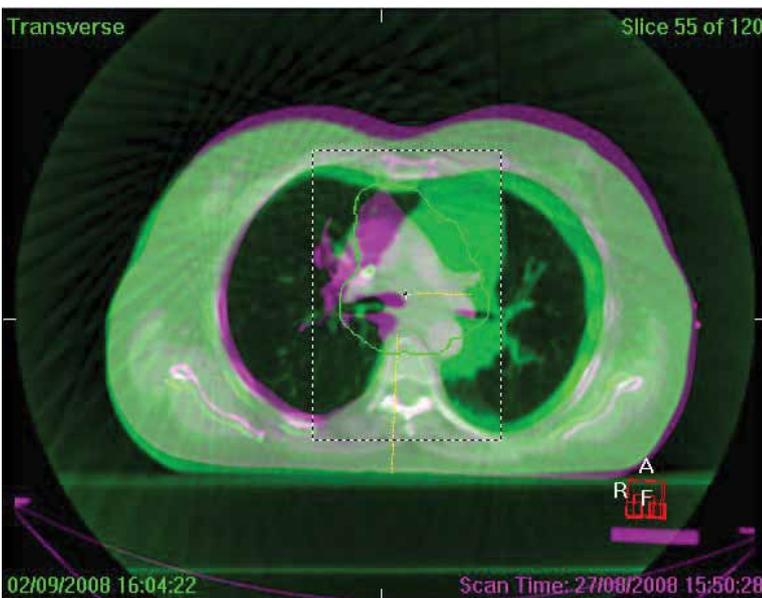


Figure 3: Elekta Synergy® VolumeView™ – fraction 3 at level of carina showing bony anatomy and patient outline match is acceptable, but soft tissue anatomy does not match, (RT planning scan purple, CBCT green).

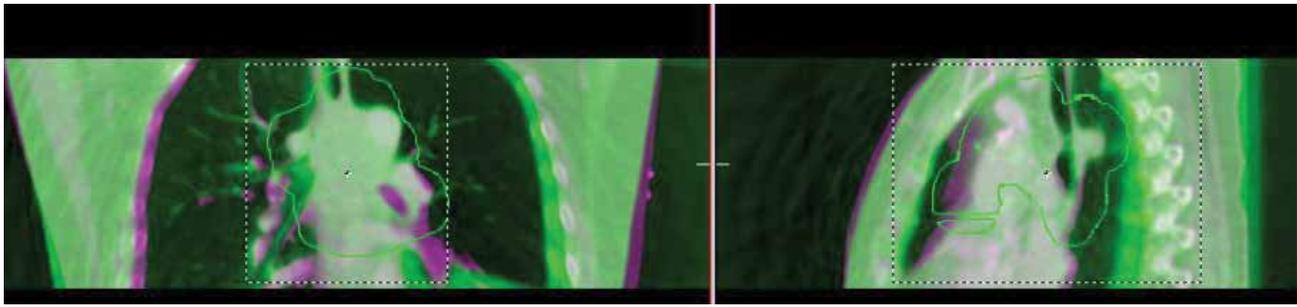


Figure 4: Elekta Synergy® VolumeView™ – fraction 4 showing similar level of bony anatomy match, good match of patient outline and much improved soft tissue anatomy, suggestive that the left lung has now re-inflated and the left main bronchus is no longer entirely blocked.

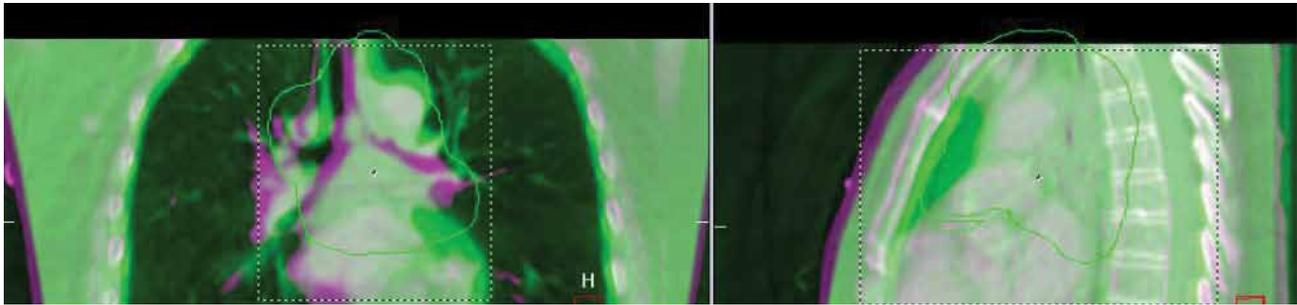


Figure 5: Elekta Synergy® VolumeView™ – fraction 13, the carina has opened up, although evidence of disease still is apparent.

## Outcome and follow-up

Follow-up six weeks post RT showed reduction in the size of chest disease.

## Discussion

Although it is not routine practice to commence radical RT with a parallel pair prior to a conformal plan in our department, normally there is adequate lead time from a referral during chemotherapy. In this case chemotherapy was stopped and RT was required immediately. It was somewhat advantageous that this patient did commence treatment with a simple technique, as the internal changes that took place when her lung collapsed, possibly after the first fraction of RT had less impact than if she was being treated with a conformal plan. The lung re-inflated spontaneously after fraction three and the patient was monitored for any further changes during the remainder of the course. It would be unlikely that a further collapse would occur, but if it did, then modification to the patients RT plan may have been necessary. This was the case in a second radical thorax patient who had a collapsed lung prior to the RT planning scan, and with this recent experience in mind, a modified verification policy was set up for him. The intention was to image routinely using 3D VolumeView™ for the first three fractions and twice weekly thereafter. His lung re-inflated after the first four fractions and his dosimetry was reviewed by physics staff and modified to account for this. He continued to be verified twice weekly and further small changes were reviewed by clinicians and physics to assess if more plan modification was required.

## Conclusion

As radiographers become more familiar with the imaging technology available to them and are educated appropriately they may be able to make more advanced decisions regarding patients treatments, but is this within the scope of their current training and remit? Currently within our own trust vicarious liability would not cover radiographers to make decisions regarding plan selection and adaptive radiotherapy. This limitation is being investigated, alongside the training and competency standards required to enable us to take that next step.

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