INTRODUCTION
Understanding the relationship between planned radiotherapy (RT) dose and parenchymal tissue evolution is imperative in furthering the study of radiation-induced lung damage (RILD). Accurate tracking and quantification of local parenchymal tissue changes in the lungs is necessary for this purpose, but traditional intensity-based registration approaches fail in this task due to dramatic geometric changes between timepoints.

AIMS
To successfully register longitudinal pre- and post-RT CT scans with considerable anatomical changes due to RILD by extracting and registering only consistent anatomical features (lung boundaries, main airways, vessels).

ACKNOWLEDGEMENTS

REFERENCES

RESULTS
The mean (std) distance for all datasets and all categories decreased from 15.95 (8.09) mm pre-registration (\(D_{\text{pre}}\)) to 4.56 (3.70) mm post-registration (\(D_{\text{post}}\)). Qualitative improvements in image alignment were observed for patient datasets in all categories. The lung boundaries and main airways were remarkably well aligned even in the most difficult cases, but small scale vessels and deeper airways could be misaligned in patients demonstrating extreme deformations.

In comparison, the \(D_{\text{pre}}\) of the traditional intensity-based registrations was higher, at 7.90 (8.97) mm. Registrations of patients with presence of atelectasis and extensive consolidation failed, producing highly implausible deformations such as the example presented in figure 6.

CONCLUSIONS
We have demonstrated that our registration method can successfully align 12-month follow-up scans from RILD patients in the presence of large anatomical changes such as consolidation and atelectasis, outperforming the classical intensity-based registration approach both quantitatively and through thorough visual inspection. This is the first time that such registration accuracy has been achieved in baseline and 12-month follow-up pairs that exhibit extensive RILD-induced changes. The results are considered suitable for longitudinal tracking of parenchymal tissue changes post-radiotherapy.