

VU Research Portal

Image-guided stereotactic radiotherapy for early stage lung cancer

Haasbeek, C.J.A.

2010

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

Haasbeek, C. J. A. (2010). *Image-guided stereotactic radiotherapy for early stage lung cancer: techniques and clinical outcomes*.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

Summary

Summary

Radiotherapy plays an important role in the curative treatment of patients with lung cancer. Chapter 2 of this thesis provides an overview of the technical advances that facilitate modern image-guided radiotherapy for both conventional and stereotactic radiotherapy. Some developments that are likely to further improve outcomes by enabling improved avoidance of surrounding normal tissues during delivery of high radiation doses are highlighted. An excellent example of the outcomes of these developments is the high local control rate achieved in early stage non-small cell lung cancer (NSCLC) with stereotactic radiotherapy (SRT).

In SRT, extremely high doses of radiation are applied to a precisely identified target area. **Chapter 3** describes the results of an analysis investigating the benefits of repeating the initial imaging study and treatment planning procedure halfway through an SRT treatment, in order to account for possible changes in tumor position. The need for such 'adaptive' planning was analyzed using repeat four-dimensional computed tomography (4DCT) scans. Only limited changes or 'time trends' were observed in target areas between the initial and repeat scans, and the dosimetric consequences proved to be minimal. This indicates that 'adaptive' treatment planning is of limited value for fractionated stereotactic radiotherapy. Using only a single 4DCT scan resulted in a more patient-friendly procedure and decreased departmental workload.

4DCT scanning, or respiration correlated CT imaging, is an essential component of target delineation for SRT. Audio-coached 4DCT acquisition can prevent imaging artifacts caused by changing respiratory patterns during 4DCT scanning, and the possible use of audio-coaching for SRT is the subject of **Chapter 4**. The changes in lung volume and tumor position between end-inspiration and end-expiration were analyzed in patients who had undergone a 4DCT scan during both free breathing and audio-coaching, which revealed a significant displacement of target positions in up to 56% of mobile tumors. This indicates that the method of audio-coaching should not be used to prevent 4DCT artifacts when the delivery technique uses non-audio coached SRT delivery.

Chapter 5 reports the early results of SRT in stage I non-small cell lung cancer treated in the VUmc, and was the largest reported single institution cohort to date. In this cohort of 206 consecutive patients who were largely considered inoperable due to extensive comorbidity, high local control rates were achieved, with a median overall survival of 34 months. The disease-free survival at 1 and 2 years was 83% and 68%, respectively. Local failure was observed in 7 patients (3%) and SRT was well tolerated, with severe late toxicity observed in less than 3% of patients.

Chapter 6 evaluated the outcomes of SRT in patients aged 75 years and older who present with a stage I non-small cell lung cancer. The number of elderly patients is increasing and they often have significant comorbidity, and may be unfit for surgery. Furthermore, surgery in the elderly is associated with increased mortality and morbidity. Since 2003, 193 patients aged ≥ 75 years were treated in the VUmc using SRT. The median Charlson comorbidity score was 4, and severe chronic obstructive pulmonary disease was present in 25%. SRT was well tolerated, and the actuarial local control rate at 3 years was 89%. Acute toxicity was uncommon and late RTOG Grade ≥ 3 toxicity was seen in less than 10% of patients. This indicates that more active diagnostic and therapeutic approaches are justified in elderly patients, and SRT should be discussed with all such patients who are considered for either conventional radiotherapy or surgery.

Another patient group with a very high risk of surgical mortality are patients who develop a new lung tumor after previous pneumonectomy. In **Chapter 7**, the outcomes of SRT for 15 such patients were studied. A new clinical stage I lung cancer developed at a median of interval of 8.9 years postpneumonectomy. At a median follow-up of 16.5 months, no local failures were observed, and only 2 patients experienced grade ≥ 3 toxicity, despite the fact that 50% of patients had severe chronic obstructive pulmonary disease. The 1-year actuarial disease-free survival rate was 92%. These findings suggest that surveillance for a second tumor is indicated in patients post-pneumonectomy, since SRT is available as a save and effective salvage option.

In **Chapter 8**, the results of non-surgical treatment options for early stage non-small cell lung cancer are reviewed, with the emphasis on the results of stereotactic radiation therapy (SRT) and radiofrequency ablation (RFA). In contrast to SRT, a lower local control rate and higher procedure-related morbidity and mortality rate has been reported for RFA, mainly caused by pneumothorax and hemorrhage. The use of SRT is becoming widespread for patients who are unfit for surgery. The reported 2-year local control rates after SRT are comparable with those achieved with surgery.

Chapter 9 discusses the issues surrounding the treatment of medically fit patients with SRT instead of resection, and future perspectives in SRT. The excellent results of SRT in patients with stage I lung cancer as reported by our group, as well as by a rapidly increasing number of international groups, has led to the situation that SRT can already be considered standard treatment for patients who are medically inoperable, and for patients at high risk of complications during surgery. Randomized trials have started to compare SRT to surgery in medically fit patients with stage I lung cancer, as the available evidence suggests that the assumption that surgery is the only gold standard no longer holds true.