Minimal Dose Computed Tomography Is Superior to Chest X-Ray For the Follow-Up and Treatment of Patients With Resected Lung Cancer

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No conflicts of interest to disclose
Outline

1. Rationale for CT in follow-up of lung cancer
2. Study Design
3. Results
   - Diagnostic Performance of MnDCT versus CXR
   - Impact on Management and Survival
4. Summary
5. Conclusion
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<tr>
<th>Organization</th>
<th>Follow-up</th>
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“The majority of recurrences from lung cancer present as distant disease which is not detected by surveillance chest x-ray...”

Benamore et al., J Thorac Oncol. 2007;2: 273–281
“The majority of recurrences from lung cancer present as distant disease which is not detected by surveillance chest x-ray...”

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“There is no evidence to suggest that earlier treatment of recurrence leads to better outcomes...”

Unger et al., Chest 2003;123:272S–283S.
The majority of recurrences from lung cancer can be detected by surveillance minimal dose CT scan at the asymptomatic loco-regional stage.

“There is no evidence to suggest that earlier treatment of recurrence leads to better outcomes...”

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Hypotheses

The majority of recurrences from lung cancer can be detected by surveillance minimal dose CT scan at the asymptomatic loco-regional stage.

Earlier treatment of recurrence may lead to prolonged survival.
CT and Effective Radiation Dose

- Standard CT: 8 mSV
CT and Effective Radiation Dose

- Standard CT: 8 mSv
- Low Dose CT: 1.5 mSv
- CXR: 0.16 mSv
CT and Effective Radiation Dose

- Standard CT: 8 mSv
- Low Dose CT: 1.5 mSv
- MnDCT: 0.2 mSv
- CXR: 0.16 mSv
Minimal Dose CT Scan (MnDCT)

MnDCT DOSE CT

LOW DOSE CT
Minimal Dose CT Scan (MnDCT)

**MnDCT DOSE CT**

**LOW DOSE CT**
Minimal Dose CT Scan (MnDCT)

MnDCT DOSE CT

LOW DOSE CT
MnDCT versus CXR

CXR
MnDCT versus CXR
MnDCT versus CXR

CXR

MnDCT
Study Design

Resection for Curative Intent (2007-2012)
Study Design

Resection for Curative Intent (2007-2012)

Consent to Study

n = 311
Study Design

Resection for Curative Intent (2007-2012)

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CXR and MnDCT at
3, 6, 12, 18, 24, 36, 48, 60 months
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CXR and MnDCT at
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Followed until
n = 271

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n = 40
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n = 14
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Symptomatic Recurrence n = 14

Asymptomatic Disease n = 49
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3, 6, 12, 18, 24, 36, 48, 60 months

Followed until
n = 271

Excluded
n = 40

Symptomatic Recurrence
n = 14

Asymptomatic Disease
n = 49

Disease Free
n = 142
Patient Population

- Stage I: 80%
- Stage II: 13%
- Stage III: 7%
- Stage IV: 1%
Patient Population

- Stage I: 13%
- Stage II: 7%
- Stage III: 1%
- Stage IV: 80%

- Lobar: 18%
- Sublobar: 2%
- Bilobar: 2%
- Pneumonectomy: 78%
## Diagnostic Performance

| CXR + MnDCT pairs analyzed and compared | 1,137 |
## Diagnostic Performance

### CXR + MnDCT pairs analyzed and compared = 1,137

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The **p-values** are significantly different at less than 0.0001 for all tests except for the **NPV** of MnDCT where it is 0.007.
Patterns of New or Recurrent Cancer

- Symptomatic: 14/63 (22%)
- Asymptomatic: 49/63 (78%)
Patterns of New or Recurrent Cancer

Distribution Over Time of the Recurrences Detected by MnDCT

- Disease Detected
  - Time in months: 3 (14%), 6 (27%), 12 (24%), 18 (16%), 24 (13%), 36 (6%), 48, 60

Graph showing the distribution of disease detection over time in months.
<table>
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New or Recurrent Cancer
n= 63
Asymptomatic (78%)
n= 49
Treatment

New or Recurrent Cancer
n= 63

Asymptomatic (78%)
n= 49

Restaging
Treatment

New or Recurrent Cancer
n= 63

Asymptomatic (78%)
n= 49

Restaging

Curative Treatment
n= 37
Treatment

New or Recurrent Cancer
n= 63

Asymptomatic (78%)
n= 49

Restaging

Curative Treatment
n= 37

Median Survival 69 months (12-76)
Treatment

New or Recurrent Cancer
n= 63

- Asymptomatic (78%)
n= 49
  - Restaging
    - Palliative Treatment
      n= 12
    - Curative Treatment
      n= 37

Median Survival
69 months (12-76)
Treatment

New or Recurrent Cancer
n= 63

Asymptomatic (78%)
n= 49

Restaging

Palliative Treatment
n= 12

Curative Treatment
n= 37

Median Survival
25 months (6-48)

Median Survival
69 months (12-76)

p<0.001
New or Recurrent Cancer
n= 63

Symptomatic (22%)
n= 14

Asymptomatic (78%)
n= 49

Restaging

Palliative Treatment
n= 12

Median Survival
25 months (6-48)

Curative Treatment
n= 37

Median Survival
69 months (12-76)

p<0.001
New or Recurrent Cancer
n= 63

Symptomatic (22%)
n= 14

Asymptomatic (78%)
n= 49

Palliative treatment
n= 14

Restaging

Palliative Treatment
n= 12

Curative Treatment
n= 37

Median Survival
25 months (6-48)

Median Survival
69 months (12-76)

p<0.001
Treatment

New or Recurrent Cancer
n = 63

Symptomatic (22%)
n = 14

Palliative treatment
n = 14

Median Survival
15 months (7-63)

Asymptomatic (78%)
n = 49

Restaging

Palliative Treatment
n = 12

Median Survival
25 months (6-48)

Curative Treatment
n = 37

Median Survival
69 months (12-76)

p < 0.001
Survival

- Asymptomatic recurrence and active treatment
- Asymptomatic recurrence and palliative treatment
- Recurrence with symptoms

Survival Time

Percent Survival
1. Surveillance by MnDCT after lung cancer resection allows for the detection of asymptomatic loco-regional disease within 3 years of operation
Summary

1. Surveillance by MnDCT after lung cancer resection allows for the detection of asymptomatic loco-regional disease within 3 years of operation

2. Earlier treatment of asymptomatic disease is associated with long survival
Limitations

- Length time and lead time bias
- Selection bias
- Small number of patients
- Inability to truly distinguish between recurrence or new primary
- Accessibility to MnDCT
Questions for Phase II

- Indirect costs of MnDCT due to low PPV?
- Accessibility and radiologist expertise?
- Are there a subset of patients who would benefit more than others from MnDCT?
- What are optimal follow-up intervals?
- Should we change practice?
Conclusions

1. MnDCT should be the modality of choice for surveillance after resection of lung cancer
Conclusions

1. MnDCT should be the modality of choice for surveillance after resection of lung cancer

2. Recurrent or new cancer detected by MnDCT should be evaluated for aggressive treatment for long survival
Thank You

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months

Excluded
n= 40

Data Analysis
n= 271

5 years
disease free
n= 45

New or Recurrent
Lung Cancer
n= 63

Follow-up
Ongoing
n= 163
New or Recurrent Cancer
n= 63

Symptomatic (22%)
n= 14

Palliative treatment
n= 14

Median Survival
15 months (7-63)

Asymptomatic (78%)
n= 49

Palliative Treatment
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Median Survival
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Curative Treatment
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69 months (12-76)