Stereotactic body radiotherapy for thoracic and soft tissue malignancies

Alexander Gottschalk, M.D., Ph.D.
Associate Professor
Director of CyberKnife Radiosurgery
Department of Radiation Oncology
University of California San Francisco

Outline

Thoracic Recurrences
  Recurrence after surgery for lung cancer
    Give an example
    Review data for SBRT on NSCLC lung cancer
  Recurrence of other cancer in the lung (metastasis)
    Give an example
    Review data for surgery and SBRT for lung metastasis
  Recurrence of other cancer in the mediastinum
    Give an example

Soft tissue recurrence
  Metastasis

SBRT for Local Recurrence

87 yo woman
2005 SOB -> RUL mass CXR
CT -> RUL and RLL mass
2/06 BX RUL -> NSCLCa
5/06 wedge resection of both RUL and RLL masses
  Path -> both showed adeno ca
  Followed with serial scans
1/07 CT -> new RUL mass
3/08 CT -> RUL mass 1 cm
6/08 CT -> RUL mass 1.9 cm
10/08 CT -> RUL mass 2.3 cm adjacent to prior wedge site. No other disease
### Primary Lung Cancer
#### T1&2 - SBRT

<table>
<thead>
<tr>
<th>1st Author</th>
<th># of Pts</th>
<th>Dose (Gy)</th>
<th>Median FU (mo)</th>
<th>Local Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>McGarry</td>
<td>47</td>
<td>8 - 24 x 3 fx</td>
<td>27 for T1, 19 for T2</td>
<td>79%</td>
</tr>
<tr>
<td>Onishi</td>
<td>257</td>
<td>BED 108 (57-180)</td>
<td>53</td>
<td>86%</td>
</tr>
<tr>
<td>Uematsu</td>
<td>50</td>
<td>50-60/5-10 fx</td>
<td>36 in living pts</td>
<td>94%</td>
</tr>
<tr>
<td>Nagata</td>
<td>45</td>
<td>12 x 4 fx</td>
<td>30 m</td>
<td>98%</td>
</tr>
<tr>
<td>Timmerman</td>
<td>70</td>
<td>T1:20 x 3, T2:22 x 3</td>
<td>17.6 m</td>
<td>95%</td>
</tr>
</tbody>
</table>

### SBRT for Local Recurrence

- **12/08** SBRT RUL mass 48 Gy in 4 fx
- **1/09** CT -> decrease in size of RUL mass
- **4/09** CT -> healing and scar formation
- **8/09** CT -> no change

---

- **10/08**
- **4/09**
- **8/09**
SBRT for Local Recurrence

12/08 SBRT RUL mass 48 Gy in 4 fx
1/09 CT -> decrease in size of RUL mass
4/09 CT -> healing and scar formation
8/09 CT -> no change

SBRT for Local Recurrence

12/08 SBRT RUL mass 48 Gy in 4 fx
1/09 CT -> decrease in size of RUL mass
4/09 CT -> healing and scar formation
8/09 CT -> no change
1/10 CT -> stable

SBRT for lung mets

83 yo woman
2006 Right buttock mass -> leiomyosarcoma
Resection and post-operative XRT
2/07 CT -> RUL mass 1 cm
3/07 VATS -> 2 nodules mets LMS
6/07 hemoptysis -> CT showed 2.6 cm RLL nodules

Surgery for lung metastases from sarcoma

<table>
<thead>
<tr>
<th>Reference (yr)</th>
<th>No. of Patients</th>
<th>No. of Extremity Sites</th>
<th>No. With Pulmonary Metastases</th>
<th>No. With Surgical Resection</th>
<th>No. With Complete Resection</th>
<th>Median Survival (mo)</th>
<th>2-Year Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crissman (1980-1970)</td>
<td>112</td>
<td>65</td>
<td>112</td>
<td>112</td>
<td>64 (57)</td>
<td>18*</td>
<td>0*</td>
</tr>
<tr>
<td>Putnam/Roth (1974-1982)</td>
<td>487</td>
<td>65</td>
<td>95</td>
<td>93</td>
<td>101 (75)</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>Casper (1961-1980)</td>
<td>68</td>
<td>45</td>
<td>68</td>
<td>68</td>
<td>50 (38)</td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td>Jakobson (1982-1990)</td>
<td>74</td>
<td>58</td>
<td>57</td>
<td>57</td>
<td>49 (38)</td>
<td>27</td>
<td>35</td>
</tr>
<tr>
<td>von der Osten (1970-1990)</td>
<td>78</td>
<td>51</td>
<td>78</td>
<td>78</td>
<td>61 (56)</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>MGHCC (1980-1990)</td>
<td>716</td>
<td>716</td>
<td>135</td>
<td>135</td>
<td>66 (63)</td>
<td>19</td>
<td>23</td>
</tr>
</tbody>
</table>

*Values in parenthesis are percentages. NS = not stated in text.
*Overall
*2-Year survival
### SBRT for Lung Metastases

<table>
<thead>
<tr>
<th>1st Author</th>
<th>Number of Pts</th>
<th>Dose (Gy)</th>
<th>Median FU (m)</th>
<th>Local Control</th>
<th>Number of Lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uematsu</td>
<td>22</td>
<td>30-75/5-15 fx</td>
<td>11</td>
<td>97%</td>
<td>43</td>
</tr>
<tr>
<td>Hara</td>
<td>17</td>
<td>20-30 x 1</td>
<td>13</td>
<td>70% (&lt; 30 Gy)</td>
<td>20</td>
</tr>
<tr>
<td>Lee</td>
<td>19</td>
<td>10 x 3 - 4 fx</td>
<td>18</td>
<td>86% (30 Gy)</td>
<td>26</td>
</tr>
<tr>
<td>Whyte</td>
<td>8</td>
<td>15 x 1</td>
<td>7</td>
<td>91% for both primary &amp; met</td>
<td>15</td>
</tr>
</tbody>
</table>

### SBRT for lung mets

7/07 SBRT 50 Gy in 5 fractions
Hemoptysis resolved
10/07 CT -> previous RLL mass resolved, but development of multiple new pulmonary nodules

### SBRT recurrence in the mediastinum

- 2004 (at age 12) -> right arm mass resected in China
- 2005 recurrence -> re-resection + RT in China
- 5/06 CT chest (in US) -> LLL nodule
- 6/06 resection LLL nodule -> metastatic fibrosarcoma
- 8/06 B nodules -> resected -> metastatic fibrosarcoma
- 1/07 lung nodules -> resection showed metastatic fibrosarcoma
- 1/08 CT showed LUL mass and subcarinal LN

### SBRT recurrence in the mediastinum

- 2004 (at age 12) -> right arm mass resected in China
- 2005 recurrence -> re-resection + RT in China
- 5/06 CT chest (in US) -> LLL nodule
- 6/06 resection LLL nodule -> metastatic fibrosarcoma
- 8/06 B nodules -> resected -> metastatic fibrosarcoma
- 1/07 lung nodules -> resection showed metastatic fibrosarcoma
- 1/08 CT showed LUL mass and subcarinal LN
SBRT recurrence in the mediastinum

• 3/08 (age 16) bronch & bx of subcarinal LN -> met fibrosarcoma. Gold markers placed
• Rad Onc planning CT
• SBRT 12.5 Gy x 3 to subcarinal LN and 16 Gy x to LUL mass

SBRT recurrence in the mediastinum

• 3/08 (age 16) bronch & bx of subcarinal LN -> met fibrosarcoma. Gold markers placed. Rad Onc planning CT
• SBRT 12.5 Gy x 3 to subcarinal LN and 16 Gy x to LUL mass
• Developed 1 cm esophageal ulcer. Resolved with conservative management
SBRT recurrence in the mediastinum
- 3/08 (age 16) bronch & bx of subcarinal LN -> met fibrosarcoma. Gold markers placed. Rad Onc planning CT
- SBRT 12.5 Gy x 3 to subcarinal LN and 16 Gy x to LUL mass
- Developed esophageal ulcer. Resolved with conservative management
- Alive, doing well and graduating high-school

SBRT recurrence in the soft tissue
- 27 yo man with metastatic spindle cell sarcoma on Yoldelis chemotherapy.
- Progression of disease pleural-based lung met

SBRT recurrence in the soft tissue
- 27 yo man with metastatic spindle cell sarcoma on Yoldelis chemotherapy.
- Progression of disease pleural-based lung met
- Both treated with SBRT
SBRT recurrence in the soft tissue

- 27 yo man with metastatic spindle cell sarcoma on Yoldelis chemotherapy.
- Progression of disease pleural-based lung met
- Progression of multiple other metastatic sites

Conclusions

- There is good evidence to support the use of SBRT for recurrences of primary lung cancer and metastases.
- It is feasible to treat mediastinal and soft metastasis with SBRT, but should be considered only for select patients.