Initial Results of a Multi-Institutional Proton Accelerated Partial Breast Irradiation Trial

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Background

- Breast Cancer is the most common cancer diagnosis in women living in the United States
  - Many of these women opt for breast conserving therapy with lumpectomy and post-operative radiotherapy

- Recurrence Patterns
  - Several studies have demonstrated that majority of breast cancer recurrences occur in close proximity to lumpectomy site (44% - 86%)
  - Recurrence rates elsewhere in breast are similar regardless of whether or not RT is given and similar to the rate of contralateral breast cancers

- The NSABP-B39 / RTOG 0413 clinical trial is underway evaluating the outcomes of whole breast irradiation (WBI) vs. partial breast irradiation (PBI) in women after breast-conserving surgery
  - Many centers are offering PBI treatment outside of clinical trials
Partial Breast Irradiation

- Benefits
  - Convenience
    - 1 to 2 week course vs. 5 to 6 week course
  - 10 to 80% of eligible patients do not receive BCS
  - Up to 30% of patients do not receive RT following BCS
- Potential for improved cosmesis, reduced toxicity
  - Heart and lung toxicity
Limited data on feasibility, efficacy, safety of PBI with protons
- B-39 allowed many methods of PBI, but did not include proton therapy

Very limited data on feasibility, efficacy, safety of PBI with protons, especially in patients classified as “cautionary” or “unsuitable” for off-protocol treatment by ASTRO consensus statement on PBI
- Additional questions regarding immobilization methods, imaging, breast size and PBI

Conflicting skin toxicity outcomes of Loma Linda and Mass General trials
# Proton PBI: Clinical Trials

<table>
<thead>
<tr>
<th>Study population</th>
<th>Loma Linda</th>
<th>Mass General</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 women; Tumor size ≤ 3 cm</td>
<td>20 women; Tumor size ≤ 2 cm</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment: BCS +</th>
<th>40 Gy in 10 daily fractions over 2 weeks</th>
<th>32 Gy in 4 bid fractions over 4 days</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Median f/u</th>
<th>48 months</th>
<th>12 months</th>
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<table>
<thead>
<tr>
<th>Results</th>
<th>No local failures</th>
<th>Minimal treatment toxicity</th>
</tr>
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<tbody>
<tr>
<td>OS: 96%</td>
<td>DFS: 92%</td>
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</table>

| | No recurrences | Significant acute skin toxicities |
| | | |


Primary Objective:
- To determine freedom from ipsilateral breast recurrence occurrences in patients receiving partial breast proton radiation therapy at 3 years.

Secondary Objective:
- To assess the acute and long-term toxicity of partial breast irradiation using proton therapy for the treatment of early stage breast cancer.
- To assess relationship between breast size and partial breast dosimetry.
- Compare results of post-operative vs. pre-operative partial breast irradiation.
- Determine quality of life results.
- To determine overall survival rate of patients with breast cancer treated with proton radiation at 3 years.
Results

- Interim analysis of 26 patients enrolled on study and with minimum of 6 months follow up after completion of RT
  - Median follow-up 12 months (6-25 months)
- No cancer recurrences
- Toxicity
  - Acute Toxicity:
    - 12 patients grade 1 dermatitis, 4 patients with grade 2, and 1 with grade 3 dermatitis
  - Late Toxicity:
    - 3 patients with grade 1 cosmesis (fibrosis, volume loss, retractions), 2 patients with grade 2 cosmesis (volume loss, retractions), and no grade 3+
Results

- BCTOS measures obtained at baseline (prior to RT, but after lumpectomy) and at each follow-up:

<table>
<thead>
<tr>
<th>BCTOS</th>
<th>Mean</th>
<th>Range</th>
<th>Mean Change</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>1</td>
<td>1 – 1</td>
<td>0.082</td>
<td>-0.143 – 1</td>
</tr>
<tr>
<td>Cosmesis</td>
<td>1.41</td>
<td>1 – 1.875</td>
<td>0.161</td>
<td>-0.375 – 1.625</td>
</tr>
<tr>
<td>Pain</td>
<td>1.14</td>
<td>1 – 1.333</td>
<td>-0.476</td>
<td>-1.333 – 1</td>
</tr>
</tbody>
</table>
Pictures(1)

Before RT

During RT

Four Weeks After RT

3m After RT

6m After RT

9m After RT

12m After RT
During RT

Four Weeks After RT

3m After RT

6m After RT

12m After RT
Pictures (3)

During RT

Two Weeks After RT

Five Weeks After RT

6m After RT
Pictures (4)

- During RT
- Two Weeks After RT
- Four Weeks After RT
- 6m After RT
- 9m After RT
Pictures (5)

During RT

Two Weeks After RT

Five Weeks After RT

6m After RT
Conclusion

- Regimen of proton therapy PBI after lumpectomy is well tolerated
- No excessive toxicity
- Insufficient follow-up for cancer control statistics, but no excessive recurrence risk
- Patient reported Quality of Life show excellent results
- Enrollment continues and longer follow-up required
Thank you,
-Andrew L. Chang, MD
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