Radiation Boost for Ductal Carcinoma In Situ After Whole Breast Radiation Therapy (WBRT) Improves Local Control: Analysis from Ten Pooled Academic Institutions


1Yale University, New Haven, CT, 2Institut Curie, Paris, France, 3Institut Curie, Paris 75005, France, 4Beaumont Health System, Royal Oak, MI, 5The University of Texas MD Anderson Cancer Center, Division of Radiation Oncology, Houston, TX, 6MD Anderson Cancer Center, Houston, TX, 7Brigham and Women’s Hospital, Boston, MA, 8University of Washington, Department of Radiation Oncology, Seattle, WA, 9University of Pennsylvania, Department of Radiation Oncology, Philadelphia, PA, 10Allentown Radiation Oncology Associates, Allentown, PA, 11Maisonneuve-Rosemont Hospital, Montreal, QC, Canada, 12McGill University Health Centre, Montreal, QC, Canada, 13Rutgers Cancer Institute of New Jersey, New Brunswick, NJ, 14BC Cancer Agency, Surrey, BC, Canada, 15British Columbia Cancer Agency, Victoria, BC, Canada
Background

• Breast Conservation Therapy (BCT), defined as local excision to remove the tumor followed by whole breast radiation therapy (WBRT), is a standard treatment option for early-stage breast cancers

• After WBRT, a common practice is delivery of a “radiation boost” directed to the tumor bed whereby an additional 4-8 fractions allow for dose-escalation to the region at highest risk for local recurrence

• The practice of ‘boosting’ has been demonstrated to provide a small but statistically significant reduction in IBTR risk in all age groups for invasive cancers (4% at 20 years) but robust data for DCIS specifically are lacking
Background

• Because DCIS has an excellent prognosis with very few recurrences after WBRT, demonstrating similar results specific to DCIS require large numbers of patients with very long follow up

• The purpose of this study was to create a DCIS database of patients treated with WBRT with and without a boost, to analyze the effects of the boost specifically for DCIS
Method

• An *a priori* power calculation was conducted to determine the number of patients needed to demonstrate a significant difference of 3% between boost and no-boost.

• >2,982 patients ($n_{boost} = 1,988; n_{no-boost} = 994$) estimated to be required.

• 10 academic institutions in the US, Canada, and France contributed de-identified patient-level data.

• All patients had newly diagnosed pure DCIS (no micro-invasion), treated with breast conserving surgery and received WBRT+/-boost.

• Data were uniformly re-coded at the host institution and underwent primary and secondary reviews prior to analysis.
Results

• The final cohort consisted of 4,131 DCIS patients ($n_{boost} = 2,661; n_{no-boost} = 1,470$), exceeding the sample size estimation by 39%

• Median follow-up = 9 years
• Median boost dose = 14 Gy
• Median age = 56.1 years
• + Margins=4%
Results

Boost vs. no Boost in All Patients:

IBTR-free survival for boost vs. no boost:

- 97.1% vs. 96.3% 5 yrs
- 94.1% vs. 92.5% 10 yrs
- 91.6% vs. 88.0% 15 yrs

(p = 0.0389)
Results

- Use of boost significant for IBTR on UVA (0.013)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>HR</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boost</td>
<td>no</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>0.69(0.53-0.91)</td>
</tr>
<tr>
<td>Grade</td>
<td>I</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>II/III</td>
<td>1.62(1.06-2.47)</td>
</tr>
<tr>
<td>Comedo</td>
<td>no</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>1.13(0.81-1.57)</td>
</tr>
<tr>
<td>Tamoxifen</td>
<td>no</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>0.60(0.42-0.95)</td>
</tr>
<tr>
<td>Margin</td>
<td>neg</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>positive</td>
<td>1.79(1.05-3.05)</td>
</tr>
<tr>
<td>Age</td>
<td>&lt;50</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>≥50</td>
<td>0.57(0.45-0.74)</td>
</tr>
</tbody>
</table>

MVA: Model incorporates other prognostic features
DCIS Boost/No Boost by Margin Definition
Stratified by Margin Status

“Ink on tumor” (NSABP) “<2mm” (SSO/ASTRO/ASCO)

Boost stratified by margin status

Negative: p<0.001*
Positive: p=0.9312*

Negative: p<0.001*
Positive: p=0.3392*
Results

Boost Stratified by Age (<50 vs. 50+)

Negative margin
- Age 50+: p=0.0073*
- Age<50: p=0.0166*

IBTR Failure Probability

Follow Up Time (years)
Conclusions

• This series represents the largest cohort addressing the benefits of a boost in DCIS with data from academic institutions across USA, Canada and France.

• Our findings suggest that the DCIS-boost results in a small, statistically significant, benefit in decreasing long-term IBTR across all age groups similar to that seen with invasive cancers.

• For invasive cancer, the small decreases in IBTR resulted in reduced the number of mastectomies by ~40% for patients who had received a boost (compared with no-boost).

• These data support the use of a boost for DCIS patients who have a life expectancy of >10-15 years & in whom WBRT is part of the treatment plan, to provide an added incremental benefit in decreasing IBTR.