Non interstitial techniques of Accelerated Partial Breast Irradiation

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Established APBI Techniques
- Multi-Catheter Interstitial Brachytherapy
- Mammosite Balloon Brachytherapy
- 3D-Conformal External Beam Radiotherapy
- Intraoperative Radiotherapy

Hybrid Brachytherapy Devices
- Alternative Brachytherapy Sources
- Permanent Seed Implantation

Novel External Beam Approaches
- Helical Tomotherapy
- CyberKnife
- Proton Beam Therapy

Which modality do I use?
Challenges for interstitial brachytherapy in recent years

- Technically demanding procedure
- Physics support
- Definite learning curve
Non Interstitial APBI Irradiation devices
Mammosite device

- Double-lumen catheter, inflatable balloon at tip
- Balloon placed in the lumpectomy cavity
- Placement either at 1) Primary surgery or 2) Guided by ultrasound up to 10 weeks post-operatively
- Subsequently filled by saline and contrast material
- Aim to stretch the surrounding tissue tightly around it
Mammosite device

- A high-dose rate source inserted through the inner lumen into the centre of the balloon
- Radiation delivered to the shell of tissue immediately surrounding the lumpectomy cavity.
- Most widely used regimen 34 Gy/ 10 #, 2# per day
- Dose prescribed 1 cm from the surface of the balloon.
Mammosite Results

- 1449 cases with early-stage breast cancer (BCT)
- Treated with the MammoSite device APBI
- 34 Gy in 3.4-Gy fractions
- 1255 (87%) had invasive breast cancer (IBC) (median size, 10 mm)
- 194 (13%) had ductal carcinoma in situ (DCIS) (median size, 8 mm).
- Median follow-up 54 months.

Vicini et al IJROBP 2011
The percentage of breasts with good/excellent cosmetic results (60 m) 90.6%.

Symptomatic breast seromas 13.0% of cases

Fat necrosis 2.3% cases

Table 2. Patterns of failure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>All cases (n = 1449)*</th>
<th>Invasive cases (n = 1255)*</th>
<th>DCIS cases (n = 194)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 y, n (%)</td>
<td>5-y actuarial rate (%)</td>
<td>5 y, n (%)</td>
</tr>
<tr>
<td>Breast only failures (IBTR)</td>
<td>35 (2.4)</td>
<td>3.65</td>
<td>31 (2.5)</td>
</tr>
<tr>
<td>Local and regional failures</td>
<td>2 (0.1)</td>
<td>0.16</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>All axillary failures</td>
<td>9 (0.6)</td>
<td>0.80</td>
<td>8 (0.6)</td>
</tr>
<tr>
<td>Distant failure</td>
<td>23 (1.6)</td>
<td>2.20</td>
<td>22 (1.8)</td>
</tr>
<tr>
<td>Disease-free survival</td>
<td>—</td>
<td>86.60</td>
<td>—</td>
</tr>
<tr>
<td>Overall survival</td>
<td>—</td>
<td>92.50</td>
<td>—</td>
</tr>
<tr>
<td>Cause-specific survival</td>
<td>—</td>
<td>98.80</td>
<td>—</td>
</tr>
<tr>
<td>Contralateral failure</td>
<td>19 (1.3)</td>
<td>1.94</td>
<td>17 (1.4)</td>
</tr>
</tbody>
</table>

Vicini et al IJROBP 2011
Mammosite specific limitations

- Issues with use in small breasts
- Issues with tumor beds close to the skin
- Reports of increased rib fractures
Common limitations of interstitial and mammosite

- Require 8–10 fractions over 5 days, two fractions per day
- Resources and patient commitment remain significant
- Catheter placement usually requires a general anesthesia.
Contura Multilumen balloon

- Contura multilumen balloon (CMLB) (SenoRx, Inc., Irvine, CA)
- Fivelumen catheter introduced in 2007
- Simplicity of insertion and treatment delivery
- Increased dosimetric control and the ability to maximize target coverage
- Reduced dose to skin and rib
- Less dosimetric compromise.

Arthur DW, IJROBP 2011
Strut Adjusted Volume Implant (SAVI)

- Hybrid of Mammosite and IBT
- Central channel and peripheral channels
- 3 sizes- 7, 9, or 11 struts
- Allowing for expansive dose modulation near normal tissues, such as the skin, chest wall, and heart
- Advantage of loading individual channels
- Flexibility of dose optimisation
- 34Gy in 10 #, 1 cm beyond tumour edge
Planning / Dosimetry

Yashar et al, Brachytherapy 2009
SAVI results

- 30 patients, median follow up - 1yr
- V90 - 96.2% (82- 99.6%), V150 - 24.8 cc (8.2- 40.6 cc), V200 - 12.8 cc (3.7-18.7 cc)
- Symptomatic seromas - Nil
- Asymptomatic fat necrosis - 1 (at 18 months)
- Local recurrences – None
- Cosmesis - Good to excellent in all the patients

Yashar et al, Brachytherapy 2009
Targit device

• Intrabeam device provides a point source of low energy x-rays (50 kV maximum)
• Spherical tumour bed applicator.
• Surgical positioning of appropriately sized applicator in the tumour bed
• Radiation is switched on for 20–35 min
• Surface of the tumour bed typically receives 20 Gy that attenuates to 5–7 Gy at 1 cm depth
Targit device
**Targit - Concerns**

1. Prescription at 1mm from surface
2. Entire treatment completed during surgery (non availability of full pathological details)
3. Technique best suited only for small, regular cavities
4. Relatively short follow up
Permanent
Interstitial seeds
Permanent Breast $^{103}$Pd Seed Implant (PBSI) as adjuvant partial breast irradiation.

Department of Radiation Oncology, Sunnybrook and Women’s College Health Sciences Centre, Toronto, Canada.

- Stranded 103Pd seeds implanted under ultrasound visualisation
- Special custom template to guide the needle insertion.
- Dose of 90Gy was prescribed on the target volume.
Prelim experience (BPSI)

• 17 patients received BPSI
• An average of 71 seeds were implanted. 90Gy was prescribed on the target volume.

Issues

1. Cost
2. Availability
3. Implantation technique
4. Lack of mature data

• No subcutaneous/skin side effects

Pignol et al, 2004
Summary

• Most mature data for catheter based interstitial APBI
• Non interstitial techniques present an exciting option
• Present an opportunity of simple placement and dose optimisation
• Both interstitial and non interstitial techniques are being challenged by hypofractionated XRT