Benefits of a 3-D Volumetric Marker for Delineating the Tumor Bed

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Introduction/Objectives: Methods for delineating the surgical bed after lumpectomy are challenging. Unfortunately, this impacts the delivery of radiation therapy in breast cancer patients. Surgeons often use vascular clips, however, this does not accurately define the tumor bed. Clips provide a point source, and are unreliable. Similarly, use of the seroma commonly overestimates target volume since the fluid extravasates into surrounding tissue making targeting inaccurate. Oncoplastic techniques magnify these challenges. We studied a new device that accurately marks the tumor excision site for improved targeting.

Methods: 65 patients were implanted with the BioZorb™ device during lumpectomy. Post-operative CT and treatment plans were generated for the 60 patients needing adjuvant radiation. The device was rated for visibility, and its utility in defining the target area for planning and daily treatment. Patients received the most appropriate radiation protocol for their individual situation.

Results: The BioZorb device provided a straightforward method for targeting. It was easily integrated into practice, and there were no device related complications. 42% of the patients received conventional whole breast irradiation (WBI) plus a boost, 50% received hypofractionated WBI, and 8% received accelerated partial breast irradiation (APBI). In 91% of cases, the 3-D marker was rated as fairly to very useful for treatment planning.

Conclusions: In 91% of patients, this 3-dimensional volumetric target proved to be a useful tool for delivery of post-operative radiotherapy. It also proved useful for long-term follow-up. In patients where oncoplastic techniques were used, the device was particularly useful and yielded excellent cosmetic outcomes.

PRE-OP WORKUP

- Complete History & Physical Exam, w/family history
- Informed Consent
- BRCA testing, if indicated
- Imaging Studies—Mammography, US, MRI
- Pathology from percutaneous biopsy
- Wire localization pre-op or intra-op to identify:
  - calcifications or other radiographic abnormalities
  - palpable abnormality
  - percutaneous marker
- Nodal evaluation (US, sentinel node, etc.)
- Pre-op and intraoperative antibiotics
- Relative contraindications—co-morbid medical issues (e.g. smoker, diabetic)

Wire localization, surgical excision site and specimen

Sizing instruments to assist with implant selection
Suturing volumetric marker implant to local tissue flaps (using 3-0 PDS)

Results

Pre-boost CT plans show comparison of targeting boost dose using the scar (top images) versus targeting with volumetric marker (bottom images)

Marker as seen at excision site with digital mammography 1 year following completion of surgery and radiation

Table shows summary of patients who have completed treatment (lumpectomy, placement of implant & radiation). Above treatment plan is an example of hypofractionated protocol enabled in this patient by presence of implant.

<table>
<thead>
<tr>
<th>Patients implanted</th>
<th>Age</th>
<th>Time from surgery to planning CT</th>
<th>60</th>
<th>63 yrs avg. (45-83)</th>
<th>43:0 days avg. (15-176)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>64%</td>
<td>DC</td>
<td>15%</td>
<td>DCIB</td>
<td>22% other</td>
</tr>
<tr>
<td>Node status</td>
<td>83%</td>
<td>Negative</td>
<td>17%</td>
<td>Positive</td>
<td></td>
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<tr>
<td>Radiation Therapy type</td>
<td>42%</td>
<td>conventional WBI + boost</td>
<td>52%</td>
<td>hypoFrax WBI + boost</td>
<td>8% 4PBI</td>
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<tr>
<td>Boost type</td>
<td>55%</td>
<td>electron</td>
<td>40%</td>
<td>photon</td>
<td></td>
</tr>
<tr>
<td>Marker utility for planning</td>
<td>91%</td>
<td>very or fairly useful</td>
<td>9%</td>
<td>somewhat or not useful</td>
<td></td>
</tr>
</tbody>
</table>

Case Example: 18 month after completion of treatment—excellent breast shape & contour

Conclusions

- 65 patients implanted with no device-related complications (60 completed radiation)
- Volumetric marker implantation helps delineate surgical site after tumor excision
- Particularly useful with Oncoplastic partial breast reconstruction
- Decreases ambiguity for radiation treatment planning and delivery
- Assists with target localization for boost radiation
- Assists with hypo-fractionation protocols (Canadian)—shortening course of radiation
- Useful for long-term follow up
- Excellent cosmetic outcomes