Image guided brachytherapy - Balloon techniques

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Brachytherapy technics

- **Interstitial**
- **Balloons**
- **Hybrid**

**Contraindications:**
- Small breast,
- The tumor is located close to the ribs,
- Distance to skin lower than 5 mm.
**MammoSite**

**Dose**: 3.4 Gy bid x 5 days – 34 Gy

**Normal tissue**:  
<60% of the WBRV should receive ≥ 50% of the prescribed dose

**Tissue-balloon conformance**:  
measure trapped air

**Balloon symmetry**:  
physical geometry will not deviate >2 mm

**Minimal balloon surface-skin distance**:  
ideal ≥7 mm,  
if 5–7 mm, then confirm skin dose <145%

**Dose homogeneity**:  
Volume of tissue receiving:  
150% (V150) of the prescribed dose ≤50 cc  
200% (V200) of the prescribed dose ≤10 cc
MammoSite
Target Volume Definitions
CTV = PTV = PTV_EVAL = 1.0-cm expansion of cavity
(5 mm within skin and bounded by posterior breast extent)
The MammoSite comes in small 4—5 cm, 5—6 cm spherical and a 4—6 elliptical balloon sizes to accommodate a common tumor cavity shape.
Trochar insertion: A suitable trajectory and entrance site is chosen. A simple skin nick with a scalpel allows easy transdermal passage of the trochar to make the tract for the catheter.

Introducing the catheter: The catheter is test-inflated before insertion. A rigid metal obturator eases the passage of the catheter through skin and tissue to the cavity site.

Inflating the catheter: The catheter is inflated to assess best filling. A fluid displacement of the resected specimen can assist. The balloon is deflated for wound suturing.

Closed skin with contour: The subcutaneous layer is also sutured so as to maintain the distance between balloon and skin.
Closed technique with ultrasound probe: The technique begins after an initial ultrasound study to determine size of seroma and distance to skin.

A sterile preparation is used.

The skin is anesthetized and a scalpel nick is created.

The trochar is introduced under ultrasound guidance through the skin nick and breast tissue to the seroma cavity.

Some of the fluid is released.

With the rigid obturator the catheter is passed into the seroma cavity.

Ultrasound guides the filling and correct position of the catheter.

No suturing is performed.

The wound is managed with daily dressing changes and wound care.

Oral antibiotics and pain medications may be needed.

MammoSite

From:
The treatment target presently accepted is the lumpectomy cavity plus a 1 to 2 cm margin. It should be recognized that the dimensions of the treatment target are bounded by the limits of breast tissue extension.
ASBS MammoSite Registry Trial

- 1449 patients prospectively entered;
- 2002-2004;
- Single-lumen catheter (no longer utilized);
- Final analysis (Shah et al, Ann Surg Onc 2013);
- Median follow-up: 63 months;
- 5-year local recurrence: 3.8%;
- 5-year local recurrence DCIS: 4.1%;
- 5-year local recurrence IDC: 3.7%;
- Excellent/good cosmesis: 91%.
Brachytherapy techniques

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- Hybrid

Multi-catheter → Single catheter → Multi-catheter
Design Rationale

**SAVI®**

- Single-entry
- Placed by surgeons or radiation oncologists
- Flexible dosimetry
- No skin-spacing/chest wall constraints

**Interstitial Brachytherapy**

- Highly skilled technique
- Multiple catheter insertions
- Placed by Radiation Oncologists

**Balloon Brachytherapy**

- Skin spacing limitations
- Single catheter
- Cavity dependence
- Seroma/Air issues

**Single-entry**

- Placed by surgeons or radiation oncologists
- 5 lumens – 1 central, 4 offset (5mm) from center
- Combines ease of use and simplicity of SLB with the flexibility in dosimetry of interstitial multi-catheter therapy
- Brings balloon brachytherapy back into the hands of the radiation oncologist
Brachyterapia raka piersi
Comparison – Skin spacing 6.5 mm

Single-lumen, Single dwell
Max skin – 4.3 Gy
PTV coverage - >95%/95%
V150 – 30cc   V200 – 8cc

Multi-lumen, Multi dwell
Max skin – 2.9 Gy
PTV coverage - >95%/95%
V150 – 20cc   V200 3.5 cc
Treatment – SAVI
Planning – PTV SAVI
Cavity Close to Chest Wall and Skin
PTV Extends Outside Skin and into CW
PTV Corrected to Exclude Skin and CW
Comparison between the cavity and PTV drawn, as well as the isodose distribution, with a CED (A), mimicking a balloon device, and with a SAVI (B). Moving from the periphery in, the outer most line is the 50% isodose line, the next two lines are the 100% Isodose line and PTV, followed by the 150% isodose line, 200% isodose line.
• 596 total patients were included in this analysis (69% invasive histology).
• The median age was 63.0 yrs (range 40-88 yrs), with 88% post-menopausal.
• Median tumor size was 11.0mm (range 0.0 - 60 mm) with 89% being estrogen receptor positive.
• Late toxicity (grade≥2) rates were low; telangiectasias (1.0%), seroma (3.0%) and fat necrosis (0.8%).
• Good/excellent cosmesis was seen in > 94% of subjects at all times of follow up (6 months – 60 months).
• Local control was excellent with a true recurrence/marginal miss rates of 1.3% (n=8), 0.96% (n=4) and 2.3% (n=4) for all subjects, invasive and DCIS subgroups, respectively.
Thank you