Partial Breast Radiation is Better Than Whole Breast Radiation: True vs. False

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Partial breast radiation is better

- History of breast cancer treatment
- Brief overview of surgical procedures
- Breast cancer staging
- Radiation Therapy
- Breast Conserving Therapy
- Side effects of radiation
- Partial Breast Irradiation/Techniques
- Future
History of Breast Cancer Treatment

• Two paradigms-local/regional disease vs. systemic
• Edwin Smith Surgical Papyrus 3000 to 2500 BC describes breast cancer: “There is no treatment.”
History of Breast Cancer Treatment

Hippocrates (Greece, 460-370 BC) writes generally about cancer: “It is better to omit treatment altogether … for if treated the patients die quickly.”

Galen (Greece 130-200 AD) advocated the wide excision of breast cancer “so as not to leave a single root.”
History of Breast Cancer Treatment

• Renasissance (14\textsuperscript{th}-16\textsuperscript{th} century) Ambrose Pare described swelling of axillary glands, lymphatic system first described
History of Breast Cancer Treatment

- Age of Enlightenment-Le Dran theorized that cancer progressed in stages: organ → lymph node → systemic, Petit advocated form of radical mastectomy including removal of breast, pectoral muscle, and axillary nodes
History of Breast Cancer Treatment

• Thomas Beatson-19th Century Scottish physician establishes endocrine therapy for breast cancer when he reports temporary tumor regression with surgical castration of two women
History of Breast Cancer Treatment

20th Century
Halsted radical mastectomy became standard practice
Level I nodes-lateral to the pectoralis minor muscle

Level II nodes-under the pectoralis minor muscle

Level III nodes-medial to pectoralis minor muscle
Surgical Procedures

• Radical mastectomy-breast and underlying pectoralis muscles are removed as well as nodes along axillary vein and costoclavicular ligament
• Modified radical mastectomy-removal of entire breast including level I and II nodes (preservation of pectoralis major muscle)
• Breast conserving therapy (Wide local excision)-removal of malignancy with rim of grossly normal breast parenchyma with or without axillary node dissection
# Breast Cancer Staging

<table>
<thead>
<tr>
<th>T-Primary Tumor</th>
<th>N-Nodes</th>
<th>Metastasis</th>
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<tbody>
<tr>
<td>Tis</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>T1</td>
<td>N1</td>
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<td>T4</td>
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Radiation Therapy

- First employed in 1896 by Emil Grubbe from Chicago when he treats a 55 yr old woman with breast cancer by wrapping her breast in foil and irradiating her breast for 18 consecutive nights
Radiation Therapy

- Radiation therapy for treatment of breast carcinoma is further developed in Great Britain during WWII. In the absence of general surgeons, GP performed simple mastectomies and referred patients for radiation therapy.
Radiation Therapy

• McWhirter in 1948 challenged Halstedian radical mastectomy reporting that simple mastectomy and nodal irradiation resulted in 62% five-year survival, equal to results of radical mastectomy at that time

Breast Conserving Therapy

• Breast conserving therapy (lumpectomy followed by whole breast radiation therapy) has become an accepted option in the treatment of most Stage I and II breast cancers

• In early breast cancer the disease is confined to the breast and can be surgically removed but clinically undetected deposits of neoplastic tissue remain

• Radiotherapy is added to control local regional recurrence because it may seed subsequent distant metastases
Effects of radiotherapy on local recurrence

Early Breast Cancer Trialists’ Collaborative Group, The Lancet 2000
Effects of Radiotherapy on Survival

Early Breast Cancer Trialists’ Collaborative Group, The Lancet 2000
Effects of Radiotherapy on Survival

![Graph showing survival rates with and without radiotherapy](image)

**Non-breast-cancer deaths**

**Table:**

<table>
<thead>
<tr>
<th>Years</th>
<th>Radiotherapy</th>
<th>Control</th>
<th>Difference</th>
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<td>0-4</td>
<td>291/38.9</td>
<td>244/34.4</td>
<td>-0.4 (SE 0.6)</td>
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<tr>
<td>5-9</td>
<td>327/22.5</td>
<td>239/18.4</td>
<td>-1.6 (SE 1.2)</td>
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<td>10-14</td>
<td>261/11.8</td>
<td>157/9.6</td>
<td>-5.7 (SE 1.9)</td>
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<tr>
<td>15-19</td>
<td>176/6.5</td>
<td>114/5.2</td>
<td>-5.2 (SE 2.9)</td>
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<tr>
<td>≥20</td>
<td>103/2.4</td>
<td>60/2.1</td>
<td>-14.4 (SE 5.5)</td>
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</table>

Complications of Whole Breast Radiation Therapy

- Arm edema—highest with axillary dissection and full axillary RT
- Pneumonitis—5% and increases with more lung exposed in tangent fields
- Rib fracture and brachial plexopathy—3% and 1%, highest occurrence when >50 Gy

Complications of Whole Breast Radiation Therapy

- Cardiovascular: Duke University has accumulated the largest series with n=114 with left sided breast cancers who underwent pre and post RT myocardial perfusion scans with perfusion defects noted in 63% of women after WBI.

Raj et al. Late Effects of Breast Radiotherapy, Breast Disease 2005
The Rationale of Partial Breast Radiation

- Whole breast radiation has unacceptable morbidity and mortality.
- Early breast cancer is a local disease.
- Partial breast radiation aims to decrease the recurrence of local disease with lower morbidity.
Partial Breast Radiation: The Rationale

Survival After Tumor Relapse

Does local control impact survival?

- An analysis of 1169 patients treated with BCT and RT, followed at 7.7 years
- Matched pair analysis was performed between patients with and without recurrence
- Local recurrence led to poorer 12 year survival 69% vs 88%, P<0.001
- Suggests that local recurrence serves as a nidus for distant metastases not present at time of initial treatment

Vicini et al. Cancer 2003
Partial Breast Irradiation

- Interstitial Brachytherapy Implants
- MammoSite Radiotherapy System
- Intraoperative Radiotherapy
- Three-Dimensional Conformal External Beam Radiation
Interstitial Brachytherapy Implants

- Needles introduced into breast at time of lumpectomy

Brachytherapy Implants

• 1993-2000, 174 cases of early-stage breast cancer were managed with lumpectomy followed by RT restricted to the tumor bed for 4-5 days
• These patients were matched to another group who underwent BCT and whole breast radiation
• Results-Brachytherapy was equally efficacious in preventing local recurrence at five years

MammoSite Radiotherapy System

- Balloon with double-lumen catheter
  - one lumen expands the balloon with saline and the other receives the radioactive source, placed in cavity at time of surgery or percutaneously after breast surgery
MammoSite Radiotherapy System

- Median follow-up ranging from 11-29 months
- No reports of local failures
- Cosmetic results are claimed to be good or excellent in 80 to 93% of patients

Three Dimensional Conformal Beam Radiation

Figure A-Whole breast Radiation  Figure B-Partial Breast Radiation

The Future of Partial Breast Irradiation

• National Surgical Adjuvant, Breast and Bowel Project (NSABP B-39/RTOG 0413)
  A randomised phase III study of conventional whole breast irradiation (WBI) versus partial breast irradiation (PBI) for women with stage 0, I, or II breast cancer.
NSABP B-39/RTOG 0413 SCHEMA

Patients with Stage 0, I, or II Breast Cancer Resected by Lumpectomy
Tumor Size ≤ 3.0 cm
No More Than 3 Histologically Positive Nodes

STRATIFICATION
- Disease Stage (DCIS only; invasive and node negative; invasive with 1-3 positive nodes)
- Menopausal Status (premenopausal, postmenopausal)
- Hormone Receptor Status (ER-positive and/or PgR-positive; ER-negative and PgR-negative)
- Intention to Receive Chemotherapy (yes or no)

RANDOMIZATION

GROUP 1*
Whole Breast Irradiation (WBI)
50 Gy (2.0 Gy/fraction) or
50.4 Gy (1.8 Gy/fraction)
to whole breast,
followed by optional boost**
to 60.0 Gy-66.6 Gy

GROUP 2*
Partial Breast Irradiation (PBI)**
34 Gy in 3.4 Gy fractions using multi-catheter brachytherapy
or
34 Gy in 3.4 Gy fractions using MammoSite® balloon catheter
or
38.5 Gy in 3.85 Gy fractions using 3D conformal external beam radiation

For all PBI techniques: RT given to tissue surrounding lumpectomy cavity only, BID (with a fraction separation of at least 6 hours), for a total of 10 treatments given on 5 days over a period of 5 to 10 days.
Why partial breast radiation is better than whole breast radiation...

- Shortened treatment time
- Cost reduction
  - Breast conserving treatment for more women
  - No longer will distance from a tertiary care center preclude women from radiation treatment
- Decrease toxicity to adjacent structures-heart, lungs, chest wall, contralateral breast
- Equivalent local control
Conclusion

- We have come a long way in treating breast cancer from the severely disfiguring radical mastectomy to lumpectomy with or without whole breast radiation.
- The data show that whole breast radiation can actually increase death from other causes and also has serious side effects.
- Partial breast irradiation offers women the same survival advantage without the detrimental effects of additional radiation. It will also prove to be more cost effective, efficient, and available to all.