ARROCase

Post-Mastectomy Radiation Therapy (PMRT)

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Learning Objectives

• Discuss a case of locally advanced right sided breast cancer indicated for PMRT
• Estimate the risk of recurrence without adjuvant radiation after neoadjuvant chemotherapy
• Discuss the indications and rationale for PMRT
• Review the rationale for inclusion of axillary, supraclavicular, and internal mammary fields
• Discuss the design and evaluation of 3D radiation fields for PMRT
Case: Presentation

- 72 year old woman underwent a routine bilateral screening mammogram
  - Findings: Heterogeneously dense breasts. **Prominent lymph node in the right axilla at edge of image.**

- PMH: diabetes (A1c 6.9, diet-controlled), multiple sclerosis, aortic stenosis, uterine fibroids, HLD
- PSH: L ovary removal for cystadenoma, myomectomy, lap chole, trigger finger release
- FH: Breast cancer (mother at 62y), Prostate cancer (maternal cousin), Diabetes (brother)
- Gyn: G0, menarche 12y, menopause 50s, no OCPs, Provera (2yrs for fibroids)
- Mammograms: Annual since age 54, no prior bx
- Genetics: BRCA 1/2 - negative for germline mutations
Case: Physical Exam

• General: Alert, well-appearing, NAD
• HEENT: Sclerae anicteric, oropharynx clear
• Lymph nodes: Mobile R axillary lymph nodes x 2 (2 cm and 1 cm). No L axillary, cervical, or supraclavicular adenopathy
• Breasts: R breast with 6 x 6 cm mobile mass in R central outer quadrant; additional 1 cm nodule at mammary edge at 9:00. L breast without masses or lesions
• Chest: No increased WOB on room air. Lungs clear to auscultation bilaterally.
• Heart: Normal rate and rhythm
• Abdomen: Non-distended, non-tender
• Neurologic: AOx3, grossly non-focal
• Musculoskeletal: No spinal tenderness. No LE edema
• Skin: No rashes
Case: Work-up

- Diagnostic bilateral mammogram with Tomosynthesis
  - Architectural distortion with associated 19 mm irregular mass in the outer central right breast, posterior depth. Enlarged lymph nodes in the right axilla.
  - Left breast benign
Case: Work-up

- Right breast ultrasound
  - Outer central right breast: Vague 16 x 11 x 13 mm hypoechoic, irregularly shaped, not parallel-oriented solid mass with indistinct margins and posterior shadowing at 9:00, 4 cm from nipple (CFN).
  - Right axilla: multiple enlarged, morphologically abnormal appearing lymph nodes. The largest 22 x 18 x 21 mm at 10:00, 13 CFN
Case: Work-up

• Ultrasound-guided biopsies
  – Right breast mass (core needle), 9:00, 4 CFN
    • Invasive ductal carcinoma, grade 3, extensive LVI
    • ER+ (>99%) PR+ (60%) Her2- (IHC 2, FISH neg)
    • Ki-67 30%

  – Right axillary lymph node (FNA)
    • Metastatic adenocarcinoma

  – Biopsy clips placed
Work-up for locally advanced breast cancer

• H&P

• Imaging:
  – Dx bilateral mammogram, U/S
  – Consider breast MRI
  – If T3N1 or any N2: CT CAP, bone scan or NaF PET, or FDG-PET
    • Plain films for any symptomatic bones or abnormal areas on bone scan
  – If neuro sx: MR Brain

• Biopsy: core needle biopsy of primary and FNA biopsy of any suspicious nodes. ER/PR/Her2 assessment

• Consider genetic counseling if at risk for hereditary breast cancer

• Labs: CBC, CMP, Pregnancy test if childbearing potential
Considerations for breast MRI

- May be helpful in defining **extent of disease before and after neoadjuvant systemic therapy**
- May be helpful to find **clinically occult primaries** (cT0 cN+)
  - Paget’s disease
  - Invasive lobular carcinoma poorly seen on mammogram, U/S, or physical exam
- May help define extent of disease if **multi-focal or multi-centric** disease suspected
- Screening for **simultaneous contralateral breast cancer** in patients with inherited susceptibility or strong family history
- MRI should be performed at high volume center with dedicated breast coil and breast imaging radiologists
Indications for genetic/familial assessment

• Young age at dx:
  – ≤45 yo
  – 46-50 yo but with at least one blood relative with breast/ovarian/pancreatic/prostate cancer, unknown family history, or 2nd personal breast ca.
  – ≤60 yo with **triple negative** histology

• Family hx:
  – 1 close blood relative with breast ca at age ≤50 yo, or
  – 1 close blood relative with ovarian/pancreatic/prostate (metastatic/intraductal/cribiform/high risk)
  – 2 close blood relatives with breast cancer of any age

• Ashkenazi Jewish ancestry
• Male sex

• Consider if personal hx of multiple primary breast cancers (first between 50-65 yo)
Case: Work-up (cont’d)

- **PET CT**
  - Right breast: multifocal uptake in central breast (1.9 x 1.5 cm, SUVmax 16.8) and outer central breast (SUVmax 4.4)
  - Multiple enlarged right axillary and subpectoral lymph nodes, largest 1.9 cm (SUVmax 4.6)
  - No distant metastases
Case: Work-up

• Breast MRI
  – Right breast: multifocal disease spanning spanning approximately 10.9 x 5.9 x 5.3 cm
  – Left breast: large area of regional clumped non-mass enhancement in the central left breast spanning 8.4 x 4.3 x 4.5 cm
  – Right axillary level I, II, and III and subpectoral lymphadenopathy. No left axillary or IMN lymphadenopathy

• Left breast core needle biopsy:
  – Proliferative fibrocystic changes
Case: Neo-adjuvant Treatment

• Upfront staging: cT3N3a
  – AJCC Stage IIIC (Anatomic)/IIIB (Prognostic)

• Neoadjuvant chemotherapy (NACT)
  – Adriamycin/Cyclophosphamide (AC) x 4 cycles
  – Taxol x 12 weekly cycles

• Pre-surgical Breast MRI
  – Some treatment response but residual disease remained in breast (9.4 cm span) and right axilla (all 3 levels)
Case: Surgery and Pathology

- Right simple mastectomy and axillary lymph node dissection. No reconstruction

- Pathology:
  - Residual IDC
    - Breast: 5.6 cm, 20% cellularity with treatment effect (RCB-3), Grade 2, LVI+
    - Lymph nodes: 9/15 involved
      - 4 micro-, 5 macrometastases
      - Treatment effect in 3 micro- and 4 macromets
      - ENE-
    - Stage ypT3N2a (Stage IIIB, AJCC 8th Ed. Anatomic)
  - ER+(>95%)PR+(80%)Her2-(IHC 1+), Ki-67 1%
  - Negative surgical margins

- Started adjuvant letrozole
When to consider PMRT

ASCO/ASTRO/SSO guidelines (Recht JCO 2001 and 2016)

– Node positive (Upfront or after NACT)
  • T1-2N1: consider if age < 40 and no co-morbidities or conditions increasing risk of RT toxicity
    – Small absolute LRR benefit, but low (<10%) even w/o PMRT (Tendulkar IJROBP 2012, Zeidan IJROBP 2018)
  • PMRT controversial in upfront cN1 with pathologic nodal complete response (ypN0) after NACT
    – Under active investigation in NSABP B-51
– T3/T4 (T3N0 controversial)
– Additional considerations (albeit lacking strong data support):
  • Positive margins
  • Extranodal extension
What’s the estimated recurrence risk without PMRT?

**Combined analysis of NSABP B-18 and B-27 (Mamounas JCO 2012)**

- Factors associated with increased LRR
  - Upfront clinical node positive
  - Tumor size
  - Poorer response to NACT

Pt recurrence risk predominantly at chest wall (17.6%) vs regional nodes (4.8%) at 10 years.
Rationale for PMRT

• Improves LRF, OS in pN+ pts (3 RCTs)
  – British Columbia (Ragaz JNCI 2005)
  – Danish studies
    • 82b - Pre-menopausal (Overgaard NEJM 1997)
    • 82c – Post-menopausal (Overgaard Lancet 1999)

• Improves 20-yr breast cancer-mortality in pN+ subsets (1-3 and ≥4 LN+), but not pN0
  – EBCTCG Meta-analysis (EBCTCG Lancet 2014)
# Rationale for PMRT

## Summary of randomized control PMRT trials:

<table>
<thead>
<tr>
<th>Primary Trials</th>
<th>试用</th>
<th>Years</th>
<th>N</th>
<th>Patient characteristics</th>
<th>Arms</th>
<th>RT</th>
<th>10 yr outcomes</th>
<th>20 yr outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>英国哥伦比亚</td>
<td>1979-86</td>
<td>318</td>
<td>Clinical stage I/II, pN+, pre-menopausal, mastectomy + ALND (med. 11 nodes) -&gt; CMF</td>
<td>Observation PMRT</td>
<td>CW + Axilla + SCV + IMN 37.5 Gy/16 fx 5-field (2 tang. AP SCV, PAB, IM)</td>
<td>LRF: 26%, OS: 10%</td>
<td>LRF: 37% (OS: 47%), p=0.002, p=0.03</td>
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<tr>
<td>Danish 82b</td>
<td>丹麦82b</td>
<td>1982-89</td>
<td>1708</td>
<td>Path stage II/III, pre-menopausal, mastectomy + ALND (med. 7 nodes) -&gt; CMF</td>
<td>Observation PMRT</td>
<td>CW + Axilla + SCV + IMN 50 Gy in 25 fx (or 48 Gy/22 fx) Electrons to CW/IMN, photon to SCV/axilla, PAB if large separation</td>
<td>LRF: 23%, OS: 9%</td>
<td>LRF: 45%, OS: 54%, p&lt;0.001, p&lt;0.001</td>
</tr>
<tr>
<td>Danish 82c</td>
<td>丹麦82c</td>
<td>1982-90</td>
<td>1375</td>
<td>Path stage II/III, post-menopausal, mastectomy + ALND (med. 7 nodes) -&gt; Tam</td>
<td>Observation PMRT</td>
<td>CW + Axilla and/or SCV + IMN Various dose/fractionations</td>
<td>LRF: 35%, OS: 8%</td>
<td>LRF: 36%, OS: 45%, p&lt;0.001, p=0.03</td>
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<tr>
<td>EBCTCG Meta-analysis</td>
<td>早期乳腺癌治疗合作组综合分析</td>
<td>1964–86</td>
<td>700</td>
<td></td>
<td>Observation PMRT</td>
<td>CW + Axilla and/or SCV + IMN Various dose/fractionations</td>
<td>LRF: 1.6%, OS: 3.0%</td>
<td>LRF: 28.8% (OS: 26.6%), p&gt;0.1, p=0.01</td>
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<tr>
<td></td>
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<td>1314</td>
<td>Mastectomy + ALND (med. 10 nodes)</td>
<td>pN0</td>
<td></td>
<td></td>
<td>LRF: 20.3%, OS: 3.8%</td>
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<td></td>
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<td></td>
<td>1772</td>
<td></td>
<td>pN+ (1-3 LN+)</td>
<td></td>
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<td>LRF: 32.1%, OS: 13.0%</td>
</tr>
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</table>

ALND, axillary lymph node dissection; CMF, cyclophosphamide/methotrexate/5-FU; Tam, tamoxifen; CW, chest wall; SCV, supraclavicular fossa; IMN, internal mammary nodes; EBCTCG, Early Breast Cancer Trialists Cooperative Group; PAB, Posterior-anterior beam; BCM, Breast cancer mortality
PMRT in intermediate risk pts under investigation

• MRC/EORTC SUPREMO trial (awaiting survival data)
  – 1688 patients (2008-2013)
  – Eligibility: pT1-2N1, pT3N0, or pT2N0 with Gr3/LVI
  – Arms: Mastectomy and axillary sampling + neoadjuvant or adjuvant chemotherapy with:
    • No PMRT
    • PMRT (chest wall, SCV/IMN optional, no axilla)
      – 50 Gy in 25 fractions (or 45 Gy/20 fx, 42.56 Gy/16 fx or 40 Gy/15 fx), no boost
  – 2-year QOL outcomes (Velikova Lancet Oncol 2018)
    • Mildly increased chest wall symptom score with PMRT at up to 2 years (14.1 vs 11.6) with improvement over years 1 to 2
PMRT with regional nodal irradiation (RNI)

- Supraclavicular (SCV) and internal mammary nodal (IMN) fields included in British Columbia and Danish RCTs

- **SCV**: Small (1.9%) breast-cancer mortality benefit in EORTC 22922 when combined with IMN RT. No survival benefit
  - Include if ≥4 LN+ or inflammatory breast cancer, recommended for 1-3 LN+

- **IMN**: Small (3.9%) absolute overall survival benefit in DBCG-IMN study, but non-significant in French, though study likely underpowered
  - Greatest benefit if ≥4 LN+ or central/medial tumor
PMRT with regional nodal irradiation (RNI)

PMRT patients in 3 prospective randomized or naturally allocated RNI trials:

<table>
<thead>
<tr>
<th>IMN</th>
<th>Trial</th>
<th>Years</th>
<th>N</th>
<th>Patient characteristics</th>
<th>Arms</th>
<th>RT</th>
<th>10 yr outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>(Hennequin IJROBP 2013)</td>
<td>1991-1997</td>
<td>1334</td>
<td>pN+ or central/medial tumor</td>
<td>RT CW + SCV + Axi-II (pN+)</td>
<td>50 Gy equivalent IMN: 45 Gy/18 fx, mixed phot/e-</td>
<td>59.3%</td>
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<td></td>
<td>100% mastectomy + ALND</td>
<td>RT CW + SCV + Axi-II (pN+) + IMN (first 5 intercostals)</td>
<td></td>
<td>62.6% p=0.8</td>
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<tr>
<td>DBCG-IMN</td>
<td>(Thorsen JCO 2016)</td>
<td>2003-2007</td>
<td>3089</td>
<td>pN+ T1-2 (93%) mastectomy (66%)/BCS (34%) + ALND</td>
<td>Left: RT Breast/CW + Axl-III + SCV</td>
<td>48 Gy/24 fx IMN: ant. e- or tangent photons</td>
<td>23.4% (8-yr)</td>
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<td></td>
<td>Right: RT Breast/CW + Axl-III + SCV + IMN (first 4 intercostals)</td>
<td></td>
<td>20.9% p=0.03</td>
</tr>
<tr>
<td>SCV + IMN</td>
<td>EORTC 22922 (Poortmans NEJM 2015)</td>
<td>1996-2004</td>
<td>4004</td>
<td>Stage I-III pN+ (56%) or central/med. tumor pN0 (44%) BCS (76%)/mastectomy (24%) + ALND</td>
<td>RT Breast/CW (73% of mast. in both arms)</td>
<td>50 Gy/25 fx</td>
<td>14.4%</td>
</tr>
<tr>
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<td></td>
<td>RT Breast/CW + SCV + IMN (first 3-5 intercostals)</td>
<td></td>
<td>12.5% p=0.0055</td>
</tr>
</tbody>
</table>

ALND, axillary lymph node dissection; BCS, breast conserving surgery; CW, chest wall; NS, not significant (p>0.05); SS, statistically significant (p<0.05)
Case: RT Simulation

• Supine with arms up on 15 degree breast board
  – Head turned away from treatment side to open up neck

• Wires
  – Surgical: Incision scar and drain sites
  – Boundaries
    • Superior: Clavicular head
    • Inferior: 2cm below inframammary fold (contralateral intact breast may serve as guide)
    • Medial: Midline
    • Lateral: Mid-axillary line

• Bolus
  – Material: Superflab
    • Other: custom Aquaplast cast, or wax
  – 3 mm thickness
    • Up to 1 cm depending if higher energy used
Mastectomy Scar: To boost or not to boost

- **No prospective data** for mastectomy scar boost – **not standard of care**
  - ASCO guidelines cite insufficient data for recommendation (Recht JCO 2001, 2016)

- In practice, usage may be considered in the setting of higher local recurrence risk
  - Close/positive margins
  - Poor in-breast response to neoadjuvant therapy
  - Inflammatory breast cancer

- Use in contemporary clinical trials:
  - Alliance 011202 ([Mandated](#)):
    - 10-14 Gy in 2 Gy fractions with electrons (recommended) or photons
  - NSABP B51 ([Permissible if positive or close <2mm margins](#)):
    - 12-14 Gy in 2 Gy fractions
To bolus or not to bolus

• **Usage is variable by geography**
  – Higher in North America (82%) and Australia (65%) than Europe (31%) (Vu Clin Oncol (R Coll Radiol) 2007)

• **No randomized prospective data** for its use
  – ASCO guidelines cite insufficient data for recommendation (Recht JCO 2001, 2016)

• Large Canadian retrospective study (n=1887) showed no difference local or locoregional control with omission of bolus (Nichol IJROBP 2021)
  – Caveat for pt. imbalance/selection bias: omission of bolus in recon. pts (49%) vs non-recon (4%)
Dose fractionation

• 50-50.4 Gy in 1.8-2 Gy daily fractions is standard of care

• Moderate hypofractionation (HF)
  – If no breast reconstruction, HF may be used off-trial
Moderate hypofractionation (HF)

- **43.5 Gy in 15 fx** (2.9 Gy/fx) - Chinese randomized control trial (Wang *Lancet Oncol* 2019)
  - 820 pts who underwent mastectomy without reconstruction, pN2 or pT3-4
  - Arms: 50 Gy/25 fx (SF) vs 43.5 Gy in 15 fx (HF)
  - RT: Note that electron CW fields were used
  - Outcomes (med f/u 58.5 mo): LRR non-inferior at 5-yr (8.3% HF vs 8.1% SF)
  - Toxicity: Similar acute and late toxicity, Less Gr3 acute skin toxicity with HF (3% vs 8%)

- Extrapolation of efficacy from UK START moderate hypofractionation trials
  - Mostly intact breast but 15% (START A)/8% (START B) of patients underwent mastectomy without immediate reconstruction (Haviland *Lancet Oncol* 2013)

- Safety and efficacy of hypofractionated PMRT (42.56 Gy in 16 fx) with breast reconstruction currently tested in two US randomized clinical trials
  - FABREC ([NCT03422003](https://clinicaltrials.gov/ct2/show/NCT03422003))
  - Alliance A221505 / RT CHARM ([NCT03414970](https://clinicaltrials.gov/ct2/show/NCT03414970))
Radiation fields

• 3-field technique
  – Tangential fields (x2)
    • Include chest wall, axilla (levels I-III), ± IMN (if clinically indicated and lung/heart dose constraints achievable).
  – SCV field

• IMN
  – Partially wide tangents (if lung dose constraints can be met)
  – Matching electron field is an alternative

• Mastectomy scar/drain sites
  – Cover in entirety with tangential fields (preferred) or separate electron field if necessary due to scar extension outside of tangent fields
3D planning for PMRT with RNI

• 3-field most typical (2 tangent fields, 1 SCV field)
• Mono-isocentric technique (Klein *IJROBP* 1994)
  – Half-beam block tangent fields
  – Sup-inf extent of chest wall/breast must fit in half-field
  – To match SCV field, tangent field collimators cannot be rotated

**Multi-isocentric**

**Mono-isocentric**

• Couch kicks: **Required**
  • Kick feet **away** from gantry

• Couch kicks: **None**
Target delineation

• **Targets**
  – Chest wall
  – Axilla (Levels I-III)
  – Supraclavicular fossa
  – Internal mammary nodes
  – Wired scars

• **Organs at risk**
  – Thyroid
  – Ipsilateral brachial plexus
  – Contralateral breast
  – Esophagus
  – Heart
  – Lungs
  – Spinal canal
  – If L-sided
    • Left ventricle and left anterior descending artery
    • Stomach
  – If R-sided
    • Liver
Lymph node stations made simple

Axillary levels – Relative to pec. minor:
- **Level I**: lateral
- **Level II**: post./ant. (contour first!)
- **Level III**: medial
- Start just below subclavian vessels and go down to 4/5\(^{th}\) ribs (Lv I) or obliteration of fat space (Lv II/III)

**Supraclav** – Bottom of cricoid to bottom of clavicular head

**IMN** – Along internal mammary vessels from top of 1\(^{st}\) rib to top of 4\(^{th}\) rib (~3 intercostal spaces)

For detailed boundaries, see contouring atlases (next slide)
Contouring consensus guidelines/atlases

- **RTOG** ([www.nrgoncology.org/ciro-breast](http://www.nrgoncology.org/ciro-breast))
- **ESTRO** (Offersen *Radiother Oncol* 2015)
Dose goals

Listed are ideal dose guidelines, in parentheses are acceptable limits

• Dose homogeneity:
  – Chestwall
    • Dmax < 115% (120%) Rx dose
    • V105% Rx dose < 25% (50%)
  – Overall plan
    • Dmax < 130% (140%) Rx dose
    • V10cc < 125% (130%) Rx dose

• Target coverage:
  – Chestwall: D95% Rx dose > 95% (90%)
  – Axilla and SCV: D95% Rx dose > 95% (D90% Rx dose > 90%)
  – IMN: D95% Rx dose > 90% (D90% Rx dose > 80%)

• OARs:
  – Lung (ipsilateral): V20Gy < 30% (38%), V10Gy < 50% (60%)
  – Heart: Dmean < 4Gy (5Gy)
Case: RT planning – Trial #1

- 50 Gy in 25 fractions

- **Mono-isocentric** technique used
  - 2x half-beam blocked tangents (6/10 MV photons)
  - LAO SCV field (10 MV)
  - PA SCV field (15 MV) – 15% of SCV MUs to reduce SCV hotspot

- Given high residual nodal positivity, **prioritized nodal coverage** including (SCV and IMN) while allowing for higher lung dose
  - IMN V95% > 90%
  - Lung V20Gy < 38% (acceptable limit)
Case: Dose volume hist. – Trial #1

- Target coverage is good, but Lung V20 is too high (46%)
Ways to decrease lung dose while maintaining adequate target (esp. IMN) coverage

• **Move isocenter** superiorly
  – Decreases apical lung dose from SCV field

• **Block lung** in tangent fields inferiorly
  – In order to match SCV field, collimator rotation of tangent fields is not possible. Thus, as the isocenter is moved superiorly, more anterior lung may enter tangent fields.

• May also consider trial of using **steeper tangents** and covering IMNs with **separate electron field**

• Protons, IMRT/VMAT

• Deep inspiration breath-hold
Alternative beam configurations on IMN coverage and Lung V20

IMN Mean Dose (Gy)

Lung V20 (%)

Pierce IJROBP 2002

ASSOCIATION OF RESIDENTS IN RADIATION ONCOLOGY
Case: RT planning – Trial #2

**TRIAL #1**

- R medial tang.
- SCV

**TRIAL #2**

- R medial tang.
- SCV

- Changes made in Trial #2
  - Raise isocenter 1.5 cm superiorly
  - Added inferior lung blocks using MLC
Case: Dose distribution comparison

**TRIAL #1**

**TRIAL #2**
Case: Dose volume hist. – Trial #2

- Lung V20 down to 36.6% (from 46%), with excellent V95% coverage of IMN (90.5%)
Case: Radiotherapy course

- Prior to RT start, pt developed 2 open wounds just superior to her mastectomy scar.
  - These were slow to heal, ultimately requiring delay of RT start for 5 weeks to allow for full closure.

- Pt had a significant personal event at the completion of RT. Due to the delay in RT start, her course was moderately hypofractionated to accommodate this.
  - Trial #2 selected, with dose fractionation changed to 43.5 Gy in 15 fx (from Wang Lancet Oncol 2019)

- Pt had started on letrozole prior to RT and continued it during RT

- Pt completed her RT course without delays or unexpected acute side effects.
What if this patient had desired breast reconstruction?

- **Options** for breast reconstruction
  - Autologous (TRAM flap, DIEP flap, etc.) vs implant-based (pre- or subpectoral)
  - Immediate (implant at time of mastectomy) vs delayed (tissue expanders at time of mastectomy -> expander-implant exchange at 2\textsuperscript{nd} surgery)
  - Mastectomy may be skin +/- nipple sparing

- **Timing** relative to PMRT for implant based reconstruction:
  - If delayed reconstruction, would typically perform PMRT after tissue expanders (TE) are at maximum desired size
  - No difference in complication rates if PMRT is done after TE or with final implants (Santosa *Plast Reconstr Surg* 2016)
  - Consider delaying expander implant exchange for 6 months to reduce risk of implant failure
    * Small single institution series (n=88). Implant loss if exchanged < 6 mo (22.4%) vs >6 mo (7.7%). (Peled *Plast Reconstr Surg* 2012)
Complications of reconstruction with PMRT
- After immediate implant-based recon.: **capsular contracture ~30% and implant loss ~10%** (Pu Medicine (Baltimore) 2018, meta-analysis)
- Lower relative risk of complications after 2 years with PMRT for autologous (25.6%) vs implant-based reconstructions (38.9%) (Jagsi JNCI 2018)
- Other complications include seroma, hematoma, wound dehiscence, implant extrusion

Radiation considerations with breast reconstruction
- **Conventional fractionation** is standard.
  - Moderate hypofractionation is actively studied on clinical trials (FABREC and RT CHARM)
- Sub-pectoral implants may be better suited for electron/photon matched plans than pre-pectoral implants, which may result in unacceptable cold spots in the chest wall (see image on right, Mitchell PRO 2018)
References


References (continued)


Please provide feedback regarding this case or other ARROcases to arrocase@gmail.com