# **BREAST CANCER CLINICAL SCENARIOS**

## **Clinical Scenario 1**

63 year old postmenopausal white female, G2P2, with h/o HTN, hyperlipidemia, GERD, who recently noted a lump in her right breast. Patient denies any breast pain, nipple discharge or nipple inversion bilat. On exam, there is an approximately 2.0 cm palpable lesion in upper outer quadrant. No palpable lymphadenopathy bilaterally. Former smoker (23 pk-yr). Social etoh. +FHX: M-grandmother dx’d w/ breast cancer @ 70. Mother dx’d with esophageal cancer. KPS= 90.

**Work-up Imaging**

**Mammogram/Tomosynthesis/US**= At site of palpable abnormality, there is a spiculated mass measuring 2.4 x 2.2 cm, which corresponds with ultrasound finding. No significant axillary lymphadenopathy bilat. BI-RADS 5: Highly suspicious for malignancy.

**Biopsy/surgery**

RT breast @ 11:00 axis, 6 FN, US-guided core biopsy:

* Invasive ductal carcinoma, poorly differentiated.
* Suspicious for LVI.
* Nottingham Histologic Grade:
* Tubular differentiation: 3
* Nuclear pleomorphism: 3
* Mitotic count: 3
* Tumor grade: 9/9
* Overall grade: 3

RT breast partial mastectomy @ UOQ, with sentinel lymph node bx of level 1 axillary nodes:

* Histologic type: Invasive duct carcinoma.
* Tumor Size: 32mm
* Tumor Focality: Unifocal
* LVI: present
* DCIS: DCIS present. Solid & cribriform, intermediate nuclear grade with focal central necrosis.
* Margins: Margins for invasive ca and DCIS negative. Closest margin: 2 mm anterior.
* Sentinel lymph nodes examined: 2
* Sentinel lymph nodes involved: 1 positive. No extranodal extension identified. Size of largest metastatic deposit= 3 mm.

Immunohistochemistry Results:

* ER= 100% 3+ (Strongly positive)
* PR= 95% 3+ (Strongly positive)
* HER2 by IHC: 2+, Equivocal
* HER2 by FISH: Negative.
	+ Her2:CEP17 ratio: 1.2
	+ Average number of Her2 signals per cell: 4.15
	+ Average number of CEP17 signals per cell: 3.35
* Ki-67= 3+ in 21%, high proliferation.

**Radiation Therapy Summary**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Plan | Beam Energy | Fractions | Dose/fx(cGy) | Total Dose(cGy) | First txt | Last txt |
| RT breast, axillary LNs | 15X/6X | 26 | 180 | 4680 | 5/1/18 | 6/5/18 |
| RT S’clav | 15X | 26 | 180 | 4680 | 5/1/18 | 6/5/18 |
| Lumpectomy tumor bed boost | 15 MeV | 7 | 200 | 1400 | 6/6/18 | 6/14/18 |

Radiation therapy was administered to the breast and supraclavicular lymph nodes with a 3D- conformal plan. The boost to the lumpectomy cavity was delivered via an electron boost. The patient tolerated treatment well with only the expected mild to moderate skin erythema and patchy dry desquamation. Patient to start Anastrozole soon.

Post-surgery, patient also received ACT chemotherapy.

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| Scenario 1 |
| Primary Site |  | MP Rule |  | Clinical Grade |  |
| Histology |  | H Rule |  | Pathological Grade |  |
| Behavior |  |  |  | Post Therapy Grade |  |
|  |  |
| Stage Data items |
| *Clinical Tumor Size* |  | *Pathological Tumor Size* |  | Tumor Size Summary |  |
| AJCC Stage |
| Clinical T |  | Pathological T |  | Post-therapy T |  |
| cT Suffix |  | pT Suffix |  | pT Suffix |  |
| Clinical N |  | Pathological N |  | Post-therapy N |  |
| cN Suffix |  | pN Suffix |  | pN Suffix |  |
| Clinical M |  | Pathological M |  | Post-therapy M |  |
| Clinical Stage  |  | Pathological Stage |  | Post-therapy Stage |  |
| *Grade Her 2 ER PR*  | *Grade G3 Her 2 ER PR*  | *Grade Her 2 ER PR* |
| Summary Stage 2018  |  |
| *EOD Primary Tumor* |  |
| *EOD Lymph Regional Nodes* |  |
| *EOD Mets* |  |
| Regional Nodes Positive |  |
| Regional Nodes Examined |  |
| Sentinel Lymph Nodes Positive |  |
| Sentinel Lymph Nodes Examined |  |
| Lymphovascular Invasion |  |
| SSDI’s |
| Lymph Nodes Positive Axillary Level I-II |  |
| ER Summary |  |
| ER Percent Positive |  |
| ER Allred Score |  |
| PR Summary |  |
| PR Percent Positive |  |
| PR Allred Score |  |
| HER2 Overall Summary |  |
| HER2 IHC Summary |  |
| HER2 ISH Summary |  |
| HER2 ISH DP Ratio |  |
| HER2 ISH DP Copy No |  |
| HER2 ISH SP Copy No |  |
| Ki-67 (MIB-1) |  |
| Oncotype DX Recur Score |  |
| Oncotype Dx Risk Level Invasive |  |
| Oncotype DX Recur Score - DCIS |  |
| Oncotype Dx Risk Level - DCIS |  |
| Multigene Signature Method |  |
| Multigene Signature Result |  |
| Response Neoadjuv Therapy |  |
| Radiation-Scenario 1 |
|  | Phase 1 | Phase 2 | Phase 3 |
| Rad Primary Treatment Volume |  |  |  |
| Rad Treatment Modality |  |  |  |
| Radiation to Draining Lymph Nodes |  |  |  |
| Ext Beam Rad Planning Technique |  |  |  |
| Dose per Fraction |  |  |  |
| Number of Fractions |  |  |  |
| Total Dose |  |  |  |
| # of Phases of Rad Tx to this Volume |  |
| Rad Treatment Discontinued Early |  |
| Total Dose |  |
| Reason no Radiation  |  |

## **Clinical Scenario 2**

71 year-old Asian female with h/o Hashimoto thyroiditis, chronic sinusitis, who recently underwent routine screening breast imaging with abnormal findings on left breast. On breast exam, there are no discreet masses on either breast. No nipple discharge or inversion. No palpable axillary adenopathy. Patient is a former smoker (10 pk-yr). No etoh consumption and no family history of cancer.

**Work-up Imaging**

Left breast screening mammogram/US: No suspicious sonographic findings bilat. On mammogram, there are new suspicious clusters of pleomorphic microcalcifications in left UOQ. Biopsy recommended. BI-RADS 4: suspicious.

**Biopsy/surgery**

* Left breast @ 9:00, 1 cm FN, mammo-guided core bx:
	+ Ductal carcinoma in situ (DCIS), solid and cribriform patterns
	+ Low to intermediate nuclear grade.
	+ Calcifications present in association with DCIS and benign ducts.
	+ ER= 100% 3+. PR= 100% 3+.
* Left partial mastectomy with sentinel lymph node bx:
	+ Histologic Type: Ductal Carcinoma In Situ (DCIS), solid and cribriform types
	+ Tumor Size: 9mm
	+ Grade: intermediate nuclear grade.
	+ Extension: No invasive or microinvasive component found. No necrosis.
	+ Lymph Nodes
		- 0/1 sentinel lymph node negative
		- 0/1 non-sentinel lymph node negative.
	+ Margins: Negative. Closest margin >5 mm.

**Oncotype Dx Recurrence Score – DCIS**

* Recurrence score of 67 (high risk of recurrence)

**Radiation Therapy Summary**

Patient received a hypofractionated accelerated regimen. The left breast received a total dose of 4256 cGy, 266 cGy in 16 fractions using 3D Field-in-Field (FinF) technique with breast tangents @ 100 SAD, using 6MV photons. This was followed by a boost to the lumpectomy cavity, consisting of 250 cGy in four fractions, 6MV, 3D-conformal for a total dose of 5256 Gy. Patient tolerated the treatment well with no treatment interruptions.



|  |  |
| --- | --- |
| Target Volume | Initial |
| Left Breast |
| Treatment Planning |  |
| Imaging  | New CT Sim |
| Motion Mgmt | Breath Hold |
| Modality | Photon EBRT |
| Planning | 3D |
| Fields | Tangents |
| Energy/Source | 6 MV |
| Prescribed to  | Isodose per plan |
| Fraction & Dosing |  |
| Fraction Dose | 2.66 Gy |
| Fraction Number | 16 |
| Fractions/week | 1 fx daily |
| Total Dose | 42.56 Gy |
| Cumulative EBRT Dose | 42.56 Gy |

**Medial Breast Tangent Parameters**

|  |  |
| --- | --- |
| Machine Scale | Variant IEC |
| Energy Mode | 6X |
| Dose Rate | 600 MU/min |
| Technique | **Static IMRT** |
| Source-axis-distance (SAD) | 100.0 cm |
| Calculated Source-skin-distance (SSD) | 91.9 cm |
| Field Size | 9.0 cm x 17.0 cm (X1: +2.5 cm, X2: +6.5 cm, Y1: +7.0 cm, Y2: 10.0 cm) Asymmetric X&Y |
| Gantry Rtn | 300.0 deg |
| Coll Rtn | 10.0 deg |
| Couch Rtn | 0.0 deg |
| Field Normalization Method |  |
| Field Normalization Factor |  |
| Field Weight Factor |  |
| MLC Transmission factor | 1.3% |
| MU | 169 |

**Lateral Breast Tangent Parameters**

|  |  |
| --- | --- |
| Machine Scale | Variant IEC |
| Energy Mode | 6X |
| Dose Rate | 600 MU/min |
| Technique | **Static IMRT** |
| Source-axis-distance (SAD) | 100.0 cm |
| Calculated Source-skin-distance (SSD) | 91.2 cm |
| Field Size | 8.5 cm x 17.0 cm (X1: +6.0 cm, X2: +2.5 cm, Y1: +7.0 cm, Y2: 10.0 cm) Asymmetric X&Y |
| Gantry Rtn | 123.0 deg |
| Coll Rtn | 350.0 deg |
| Couch Rtn | 0.0 deg |
| Field Normalization Method |  |
| Field Normalization Factor |  |
| Field Weight Factor |  |
| MLC Transmission factor | 1.3% |
| MU | 165 |

*Static IMRT* is another way of describing Field-in-Field technique, which is basically a 3D-Conformal plan.

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| Scenario 2 |
| Primary Site |  | MP Rule |  | Clinical Grade |  |
| Histology |  | H Rule |  | Pathological Grade |  |
| Behavior |  |  |  | Post Therapy Grade |  |
|  |  |
| Stage Data items |
| *Clinical Tumor Size* |  | *Pathological Tumor Size* |  | Tumor Size Summary |  |
| AJCC Stage |
| Clinical T |  | Pathological T |  | Post-therapy T |  |
| cT Suffix |  | pT Suffix |  | pT Suffix |  |
| Clinical N |  | Pathological N |  | Post-therapy N |  |
| cN Suffix |  | pN Suffix |  | pN Suffix |  |
| Clinical M |  | Pathological M |  | Post-therapy M |  |
| Clinical Stage  |  | Pathological Stage |  | Post-therapy Stage |  |
| *Grade G3 Her 2 ER + PR +* | *Grade G3 Her 2 ER + PR +* | *Grade Her 2 ER PR* |
| Summary Stage 2018  |  |
| *EOD Primary Tumor* |  |
| *EOD Lymph Regional Nodes* |  |
| *EOD Mets* |  |
| Regional Nodes Positive |  |
| Regional Nodes Examined |  |
| Sentinel Lymph Nodes Positive |  |
| Sentinel Lymph Nodes Examined |  |
| Lymphovascular Invasion |  |
| SSDI’s |
| Lymph Nodes Positive Axillary Level I-II |  |
| ER Summary |  |
| ER Percent Positive |  |
| ER Allred Score |  |
| PR Summary |  |
| PR Percent Positive |  |
| PR Allred Score |  |
| HER2 Overall Summary |  |
| HER2 IHC Summary |  |
| HER2 ISH Summary |  |
| HER2 ISH DP Ratio |  |
| HER2 ISH DP Copy No |  |
| HER2 ISH SP Copy No |  |
| Ki-67 (MIB-1) |  |
| Oncotype DX Recur Score |  |
| Oncotype Dx Risk Level Invasive |  |
| Oncotype DX Recur Score - DCIS |  |
| Oncotype Dx Risk Level - DCIS |  |
| Multigene Signature Method |  |
| Multigene Signature Result |  |
| Response Neoadjuv Therapy |  |

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| Radiation-Scenario 2 |
|  | Phase 1 | Phase 2 | Phase 3 |
| Rad Primary Treatment Volume |  |  |  |
| Rad Treatment Modality |  |  |  |
| Radiation to Draining Lymph Nodes |  |  |  |
| Ext Beam Rad Planning Technique |  |  |  |
| Dose per Fraction |  |  |  |
| Number of Fractions |  |  |  |
| Total Dose |  |  |  |
| # of Phases of Rad Tx to this Volume |  |
| Rad Treatment Discontinued Early |  |
| Total Dose |  |
| Reason no Radiation  |  |

## **Clinical Scenario 3**

59 year-old postmenopausal Hispanic female with history of left calf malignant melanoma in 2006, status post, Mohs’ resection and immunotherapy, who underwent routine screening mammogram with suspicious findings on right breast. On exam, there are no palpable lesions on either breast. Patient denies any nipple discharge. No observable nipple retraction and no palpable axillary lymphadenopathy. Nonsmoker. Social drinker. +FHX: Mother and M-grandmother dx’d with breast cancer. Given patient’s family h/o breast cancer, pt underwent genetic testing with BRCA 1/2 negative results.

**Work-up Imaging**

* MMG/US: Right subareolar breast nodule, 6 mm. US with same finding.
* MRI breast bilat: Intensely enhancing 9 mm lesion, retroareolar. No other focus of enhancement seen on LT or RT breast. No evidence of axillary lymphadenopathy.

**Biopsy/surgery**

* RT Breast, subareolar @ 1:00, US-guided bx:
	+ Invasive ductal carcinoma.
	+ Tumor grade: 8/9.
	+ Max length in a single core= 7 mm.
	+ DCIS, cribriform, solid, intermediate nuclear grade.
	+ ER/PR+. HER2: 1+, NEG.
* Right SAVI Scout Reflector Localized partial mastectomy with sentinel lymph node bx:
	+ Tumor Size: 10mm
	+ Focality: Unifocal
	+ Histologic Type: Invasive carcinoma of no special type (NST) with lobular features.
	+ Grade: 9/9. Overall Nottingham grade: 3.
	+ DCIS, Solid, intermediate nuclear grade.
	+ No clear-cut morphological evidence of lymphovascular invasion.
	+ Sentinel Lymph Nodes= 0/1 negative.
	+ Margins negative. Closest margin= 6 mm inf.
* Immunohistochemistry Results:
	+ ER= 3+ positive in 99%.
	+ PR= 3+ positive in 70%
	+ HER2: 0+, negative.
	+ Ki-67= 3+ in 31%, high proliferation.
	+ Luminal B subtype.
	+ Oncotype DX Recurrence Score= 14.

**Radiation Therapy Summary**

Patient underwent IORT to right breast, using the Zeiss Intrabeam XRS 50 Kv unit. Prescribed dose to the surface was 20 Gy, with a 4.0 cm applicator. Dose rate = 0.712 Gy/minute @ the surface. Treatment time = 28 minutes, 45 seconds by ionization chamber second check measurements. Ultrasound simulations confirmed that the skin to applicator distances were: 1.12 cm sup, 0.98 cm lat, 1.1 cm inf, and 0.8 cm medially, all within acceptable distances. IORT was followed by EBRT as detailed below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Plan | Beam Energy | Fractions | Dose/fx(cGy) | Total Dose(cGy) |
| RT breast | 6 MV | 25 | 180 | 4500 |

|  |  |
| --- | --- |
| Target Volume | Initial |
| RT 1:00 lumpectomy cavity |
| Treatment Planning |  |
| Imaging  | Ultrasound Sim |
| Motion Mgmt |  |
| Modality | HDR Brachytx |
| Planning | 2D |
| Fields | Applicator |
| Energy/Source | Electronic kV |
| Prescribed to  | Depth 0 cm |
| Fraction & Dosing |  |
| Fraction Dose | 20 Gy |
| Fraction Number | 1 |
| Fractions/week | 1 fx daily |
| Total Dose | 20 Gy |
| Cumulative EBRT Dose | 20 Gy |

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| Scenario 3 |
| Primary Site |  | MP Rule |  | Clinical Grade |  |
| Histology |  | H Rule |  | Pathological Grade |  |
| Behavior |  |  |  | Post Therapy Grade |  |
|  |  |
| Stage Data items |
| *Clinical Tumor Size* |  | *Pathological Tumor Size* |  | Tumor Size Summary |  |
| AJCC Stage |
| Clinical T |  | Pathological T |  | Post-therapy T |  |
| cT Suffix |  | pT Suffix |  | pT Suffix |  |
| Clinical N |  | Pathological N |  | Post-therapy N |  |
| cN Suffix |  | pN Suffix |  | pN Suffix |  |
| Clinical M |  | Pathological M |  | Post-therapy M |  |
| Clinical Stage  |  | Pathological Stage |  | Post-therapy Stage |  |
| *Grade Her 2 ER PR*  | *Grade Her 2 ER PR*  | *Grade Her 2 ER PR* |
| Summary Stage 2018  |  |
| *EOD Primary Tumor* |  |
| *EOD Lymph Regional Nodes* |  |
| *EOD Mets* |  |
| Regional Nodes Positive |  |
| Regional Nodes Examined |  |
| Sentinel Lymph Nodes Positive |  |
| Sentinel Lymph Nodes Examined |  |
| Lymphovascular Invasion |  |
| SSDI’s |
| Lymph Nodes Positive Axillary Level I-II |  |
| ER Summary |  |
| ER Percent Positive |  |
| ER Allred Score |  |
| PR Summary |  |
| PR Percent Positive |  |
| PR Allred Score |  |
| HER2 Overall Summary |  |
| HER2 IHC Summary |  |
| HER2 ISH Summary |  |
| HER2 ISH DP Ratio |  |
| HER2 ISH DP Copy No |  |
| HER2 ISH SP Copy No |  |
| Ki-67 (MIB-1) |  |
| Oncotype DX Recur Score |  |
| Oncotype Dx Risk Level Invasive |  |
| Oncotype DX Recur Score - DCIS |  |
| Oncotype Dx Risk Level - DCIS |  |
| Multigene Signature Method |  |
| Multigene Signature Result |  |
| Response Neoadjuv Therapy |  |

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| --- |
| Radiation-Scenario 3 |
|  | Phase 1 | Phase 2 | Phase 3 |
| Rad Primary Treatment Volume |  |  |  |
| Rad Treatment Modality |  |  |  |
| Radiation to Draining Lymph Nodes |  |  |  |
| Ext Beam Rad Planning Technique |  |  |  |
| Dose per Fraction |  |  |  |
| Number of Fractions |  |  |  |
| Total Dose |  |  |  |
| # of Phases of Rad Tx to this Volume |  |
| Rad Treatment Discontinued Early |  |
| Total Dose |  |
| Reason no Radiation  |  |

## **Clinical Scenario 4**

55-year-old W/F, who on routine screening breast imaging had abnormal findings on LT breast. Patient is asymptomatic, denies any breast masses bilat. No nipple retraction or discharge. On exam, no palpable adenopathy on right/left axilla. Non-smoker. Social alcohol use. No family hx of cancer.

**Work-up Imaging**

Bilateral screening mmg/US= New grouped pleomorphic calcifications on left breast @ 1:00.

Unilateral LT breast mmg/US callback= In left breast @ 1:00 axis, there are grouped pleomorphic calcifications spanning about 8 mm. BI-RADS 4: suspicious.

**Biopsy/surgery**

Left breast @ 1:00 axis, 3FN, US-guided core bx= DCIS, solid type, low nuclear grade. Largest dimension in a single core= 8 mm.

Left breast SAVI Scout localizer partial mastectomy with sentinel lymph node bx= 0.9 cm DCIS, solid & cribriform, low nuclear grade. No invasive component present. SLNs= 0/2 neg Margins negative. Closest margin @ 3 mm lat. Stage pTis, pN0 (sn).

Immunohistochemistry Results:

ER= 3+ positive in 90%. PR= 3+ positive in 85%.

**Radiation Therapy Summary**

Using a 6-1 mini SAVI catheter, the lumpectomy cavity received 34 Gy in 10 treatments, BID.

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| Scenario 4 |
| Primary Site |  | MP Rule |  | Clinical Grade |  |
| Histology |  | H Rule |  | Pathological Grade |  |
| Behavior |  |  |  | Post Therapy Grade |  |
|  |  |
| Stage Data items |
| *Clinical Tumor Size* |  | *Pathological Tumor Size* |  | Tumor Size Summary |  |
| AJCC Stage |
| Clinical T |  | Pathological T |  | Post-therapy T |  |
| cT Suffix |  | pT Suffix |  | pT Suffix |  |
| Clinical N |  | Pathological N |  | Post-therapy N |  |
| cN Suffix |  | pN Suffix |  | pN Suffix |  |
| Clinical M |  | Pathological M |  | Post-therapy M |  |
| Clinical Stage  |  | Pathological Stage |  | Post-therapy Stage |  |
| *Grade Her 2 ER PR*  | *Grade Her 2 ER PR*  | *Grade Her 2 ER PR* |
| Summary Stage 2018  |  |
| *EOD Primary Tumor* |  |
| *EOD Lymph Regional Nodes* |  |
| *EOD Mets* |  |
| Regional Nodes Positive |  |
| Regional Nodes Examined |  |
| Sentinel Lymph Nodes Positive |  |
| Sentinel Lymph Nodes Examined |  |
| Lymphovascular Invasion |  |
| SSDI’s |
| Lymph Nodes Positive Axillary Level I-II |  |
| ER Summary |  |
| ER Percent Positive |  |
| ER Allred Score |  |
| PR Summary |  |
| PR Percent Positive |  |
| PR Allred Score |  |
| HER2 Overall Summary |  |
| HER2 IHC Summary |  |
| HER2 ISH Summary |  |
| HER2 ISH DP Ratio |  |
| HER2 ISH DP Copy No |  |
| HER2 ISH SP Copy No |  |
| Ki-67 (MIB-1) |  |
| Oncotype DX Recur Score |  |
| Oncotype Dx Risk Level Invasive |  |
| Oncotype DX Recur Score - DCIS |  |
| Oncotype Dx Risk Level - DCIS |  |
| Multigene Signature Method |  |
| Multigene Signature Result |  |
| Response Neoadjuv Therapy |  |
|  |  |
| Radiation |
|  | Phase 1 | Phase 2 | Phase 3 |
| Rad Primary Treatment Volume |  |  |  |
| Rad Treatment Modality |  |  |  |
| Radiation to Draining Lymph Nodes |  |  |  |
| Ext Beam Rad Planning Technique |  |  |  |
| Dose per Fraction |  |  |  |
| Number of Fractions |  |  |  |
| Total Dose |  |  |  |
| # of Phases of Rad Tx to this Volume |  |
| Rad Treatment Discontinued Early |  |
| Total Dose |  |
| Reason no Radiation  |  |

**NCCN Guidelines-Invasive Breast Cancer
v3.2018**

* Whole Breast RT
	+ 45-50.4 Gy in 25-28 fractions (fx), or
	+ 40-402.5 Gy in 15-16 fx (hypofractionation preferred),
	+ Treatments 5 days/wk,
	+ Tumor bed boost recommended in patients with high risk features
* Chest Wall(CW) RT
	+ 45-50.4 Gy in 25-28 fx to CW +/- scar boost @ 1.8-2 Gy/fx for total of about 60 Gy.
* Regional Nodal RT
	+ 46-60 Gy, 23-25 fx, 5 days/wk
* Accelerated Partial Breast Irradiation (APBI)
	+ 34 Gy in 10 fx, twice a day (BID), via brachytherapy, or
	+ 38.5 Gy in 10 fx, BID, with EBRT
	+ Tumor bed boost recommended in patients with high risk features
* APBI patient selection criteria:
	+ 50 years or older, with invasive ductal ca,
	+ T1 disease with negative margin width ≥ 2 mm, no LVI, ER+, BRCA-, or
	+ Low/intermediate nuclear grade, screening detected DCIS, ≤ 2.5 mm, negative margins ≥ 3 mm