# BREAST CANCER CLINICAL SCENARIO 1

**Clinical Scenario 1**

55 yr old white female, G1P1, with no pertinent medical history presented with suspicious finding on RT breast during routine screening mammogram. Patient denies any breast pain, nipple discharge or nipple inversion bilat. On exam, benign CBE, no palpable masses on either breast. No palpable lymphadenopathy bilaterally. Nonsmoker. Social etoh. -FHX. KPS= 90.

**Work-up Imaging**

**Mammogram/Tomosynthesis**= Apparent mass in anterior of RT breast requires further evaluation. BI-RADS 0: incomplete.

**RT Mammogram/Tomo/US**= Hypoechoic mass @ 3:00 axis, retroareolar, measures 2.1 cm, corresponds to mammographic finding. Normal appearing lymph nodes in RT axilla. Birads 4: Suspicious.

**Biopsy/surgery**

RT breast @ 3:00 axis, US-guided core biopsy: invasive ductal carcinoma, well differentiated. Nottingham grade= 5/9. G1. DCIS, cribriform & micropapillary, low nuclear grade.

RT breast@ LIQ, SAVI Scout localized lumpectomy with sentinel lymph node bx: 15 mm unifocal invasive duct carcinoma. LVI-. DCIS, comedo & cribriform types, expansive comedo necrosis, intermediate nuclear grade. Margins negative. Closest margin @ 3 mm. Lymph nodes involved= 0. Lymph nodes examined= 3. Sentinel Lymph Nodes examined= 3.

**Nottingham Histologic Grade:**

* Tubular differentiation: 2
* Nuclear pleomorphism: 2
* Mitotic count: 1
* Tumor grade: 5/9.
* Overall grade: 1.

**Tumor Markers:**

* Tumor markers from bx specimen:
* ER= 94%, strong (3+). PR= 99%, strong (3+). Ki-67= 3-5%. HER2 IHC not performed.
* HER2 ISH= Not amplified.
* Average HER2 copy number: 2.28
* Average CEP17 copy number: 2.00
* Ratio of average HER2/CEP17: 1.1
* Sample adequate for analysis: Yes

**Radiation Therapy Summary**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Plan | Energy - Modality | Fractions | Dose/fx(cGy) | Total Dose(cGy) | First txt | Last txt |
| RT breast | SAVI Ir-192 | 10/10 | 340 | 3,400 | 7/28/19 | 8/1/19 |

Treatment was delivered BID and 6 hours apart each day.

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| Scenario 1 |
| Primary Site | **C50.1** | Grade Clinical | 1 |
| Histology | 8500 | Grade Pathological | 1 |
| Behavior | 3 | Grade Post Therapy |  |
|  |
| Stage Data items |
| *Clinical Tumor Size* | *021* | *Pathological Tumor Size* | *015* | Tumor Size Summary | 015 |
| AJCC Stage |
| Clinical T | cT2 | Pathological T | pT1c | Post-therapy T |  |
| cT Suffix |  | pT Suffix |  | pT Suffix |  |
| Clinical N | cN0 | Pathological N | pN0 | Post-therapy N |  |
| cN Suffix |  | pN Suffix | (sn) | pN Suffix |  |
| Clinical M | cM0 | Pathological M | cM0 | Post-therapy M |  |
| Clinical Stage  | 1B | Pathological Stage | 2A | Post-therapy Stage |  |
| *Grade G2 Her 2 - ER + PR +* | *Grade G3 Her 2 - ER + PR +* | *Grade Her 2 ER PR* |
| Summary Stage 2018  | 1-Localized |
| *EOD Primary Tumor* | 100 |
| *EOD Lymph Regional Nodes* | 070 |
| *EOD Mets* | 00 |
| Regional Nodes Positive | 00 |
| Regional Nodes Examined | 03 |
| Sentinel Lymph Nodes Positive | 00 |
| Sentinel Lymph Nodes Examined | 03 |
| Lymphovascular Invasion | 9 |
| SSDI’s |
| Lymph Nodes Positive Axillary Level I-II | 00 |
| ER Summary | 1 |
| ER Percent Positive | 094 |
| ER Allred Score | 08 |
| PR Summary | 1 |
| PR Percent Positive | 099 |
| PR Allred Score | 08 |
| HER2 Overall Summary | 0 |
| HER2 IHC Summary | 9 |
| HER2 ISH Summary | 0 |
| HER2 ISH Single Probe Copy No | XX.9 |
| HER2 ISH Dual Probe Copy No | 2.2 |
| HER2 ISH Dual Probe Ratio | 1.1 |
| Ki-67 (MIB-1) | 3.1 |
| Oncotype DX Recur Score | XX9 |
| Oncotype Dx Risk Level Invasive | 9 |
| Oncotype DX Recur Score - DCIS | XX6 |
| Oncotype Dx Risk Level - DCIS | 6 |
| Multigene Signature Method | 9 |
| Multigene Signature Result | 9 |
| Response Neoadjuvant Therapy | 0 |
| Dx Staging and Treatment |
| Diagnostic Staging Procedure | 02 |
| Surgery of Primary Site | 22 |
| Scope of Regional Lymph Nodes | 2 |
| Surgical Procedure/Other Site | 0 |
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| Phase I Radiation |
| Phase I Primary Treatment Volume | **41** |
| Phase I to Draining Lymph Nodes | **00** |
| Phase I Treatment Modality | **09** |
| Phase I External Beam Planning Technique | **88** |
| Phase I Dose Per Fraction (cGy) | **00340** |
| Phase I Number of Fractions | **010** |
| Phase I Total Dose (cGy) | **03400** |
| Phase II Radiation |
| Phase I1 Primary Treatment Volume | **00** |
| Phase II to Draining Lymph Nodes |  |
| Phase II Treatment Modality |  |
| Phase II External Beam Planning Technique |  |
| Phase II Dose Per Fraction (cGy) |  |
| Phase II Number of Fractions |  |
| Phase II Total Dose (cGy) |  |
| Phase III Radiation |
| Phase III Primary Treatment Volume |  |
| Phase III to Draining Lymph Nodes |  |
| Phase III Treatment Modality |  |
| Phase III External Beam Planning Technique |  |
| Phase III Dose Per Fraction (cGy) |  |
| Phase III Number of Fractions |  |
| Phase III Total Dose (cGy) |  |
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| Date RT Started | **7/28/19** |
| Date RT Ended | **8/1/19** |
| # of Phases of RT to this Volume | **01** |
| RT Discontinued Early | **01** |
| Total Dose | **003400** |

# BREAST CANCER CASE 2

70 y/o w/f, G2P2, h/o HTN, hypothyroidism, anxiety, who presented w/ vague fullness associated with pain in LT UOQ breast for the past month. Routine screening revealed suspicious nodule on LT breast.

**Work-up Imaging**

Bilat MMG-TOMO/US: Developing LT breast nodule. No dominant masses on RT breast. On ultrasound, lobular hypoechoic mass @ 2:00 position on LT breast, measuring 1.6 x 1.4 x 0.8 cm. BIRADS 5: Highly suggestive of malignancy.

MRI breast bilat: On LT breast, irregular spiculated mass @ UOQ, measuring 2.6 x 1.5 x 1.4 cm. Additional enhancement @ 4:00 axis, smaller mass measuring 1.3 x 1.0 x 0.6 cm. No LT axillary lymphadenopathy. No suspicious enhancement on RT breast.

**Biopsy-12/5/18**

1. LT breast, @ 2:00, US-guided bx= Moderately differentiated invasive ductal carcinoma (tubule formation 3/3, nuclear pleomorphism 2/3, mitotic count 1/3), measuring 1.1 cm in maximal length in this material.
2. LT breast, @ 4:00, US-guided bx= Well differentiated invasive ductal carcinoma (tubule formation 2/3, nuclear pleomorphism 2/3, mitotic count 1/3), measuring 0.8 cm in maximal length in this material.

**Prognostic Indicator Markers**

Bx specimen Part #1:

ER= >90%, 3+. PR= 25%, 2-3+ HER2 IHC= 0, Negative Ki-67= 18%

Bx specimen Part #2:

ER= 88%, 3+ PR= 0 HER2 IHC= 1+, Negative Ki-67= 23%

**Surgery**

1/4/19: LT breast SAVI scout reflector localized lumpectomy with mapping of LT sentinel axillary lymph nodes and left sentinel lymph node biopsy

Pathology Report

Procedure: LT breast lumpectomy, sentinel lymph node sampling,

Specimen laterality: Left

Tumor site (s): 2:00 & 4:00 axis

Tumor size:

Tumor 1: 17 mm

Tumor 2: 9 mm

Histologic Grade: Nottingham Histologic Score:

Tumor 1

* Tubular Differentiation: 3/3
* Nuclear Pleomorphism: 2/3
* Mitotic Count: 3/3
* Overall Grade: 8/9
* Grade 3

Tumor Focality: Multifocal

DCIS: present, minor component of tumor, solid & cribriform, intermediate nuclear grade.

Lymphovascular Invasion: Present, multiple foci

Margins uninvolved by invasive carcinoma.

Distance from closest margin (mm): All final margins >10 mm

Margins for DCIS: All negative

Regional lymph nodes: LT axillary sentinel lymph nodes

 Involved by tumor cells: 2

 Number of LNs with macrometastases (>2 mm): 2

 Number of LNs with micrometastases (>0.2 mm up to 2 mm and/or > 200 cells): 0

Size of largest metastatic deposit (mm): 7 mm

Extranodal extension: Present

Number of lymph nodes examined: 4

Number of sentinel lymph nodes examined: 4

Treatment effect in breast: No known prior treatment

**Surgical Immunohistochemistry Results**

Part 1 @ 2:00 axis:

ER= 71-99%, 3+ PR= 45%, 3+ HER2 IHC= 1+, Negative Ki-67= 20-25%

Part 2 @ 4:00 axis:

ER= 90%, 3+ PR= 35%, 2+ HER2 IHC= 1+, Negative Ki-67= 27%

2/12/19: ACT chemotherapy x 4 cycles

**Radiation Therapy Summary**

Mrs Doe received a dose of 5000 cGy to the left breast, left axilla and left supraclavicular regions over 25 days. 6 MV photons were used for the left breast and axillary treatments. 15 MV photons were used for the treatment of the left supraclavicular region. She received a boost of 1000 cGy in five fractions to the tumor bed, 18 MeV electrons were used to deliver this treatment. All three plans were 3D-conformal.

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| --- | --- | --- | --- | --- | --- | --- |
| **Site** | **Energy** | **Fractions** | **Dose per Fraction (cGy)** | **Dose Correction (cGy)** | **Total Dose Delivered (cGy)** | **Elapsed Days** |
| EBoost | 18E | 5 / 5 | 200 | 0 | 1,000 | 8 |
| Lt Breast-Ax | 6X | 25 / 25 | 200 | 0 | 5,000 | 34 |
| Lt Sclav | 15X | 25 / 25 | 200 | 0 | 5,000 | 34 |

Start Date: 5/27/19 End Date: 7/9/19

7/25/19: Anastrozole, 1 mg oral daily tablets.

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| Scenario 2 |
| Primary Site | **C50.9** | Grade Clinical | 2 |
| Histology | 8500 | Grade Pathological | 3 |
| Behavior | 3 | Grade Post Therapy |  |
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| Stage Data items |
| *Clinical Tumor Size* | *026* | *Pathological Tumor Size* | *017* | Tumor Size Summary | 017 |
| AJCC Stage |
| Clinical T | cT2 | Pathological T | pT1c | Post-therapy T |  |
| cT Suffix |  | pT Suffix |  | pT Suffix |  |
| Clinical N | cN0 | Pathological N | pN1a | Post-therapy N |  |
| cN Suffix |  | pN Suffix | (sn) | pN Suffix |  |
| Clinical M | cM0 | Pathological M | cM0 | Post-therapy M |  |
| Clinical Stage  | 1B | Pathological Stage | 1B | Post-therapy Stage |  |
| *Grade G2 Her 2 - ER + PR +* | *Grade G3 Her 2 - ER + PR +* | *Grade Her 2 ER PR* |
| Summary Stage 2018  | 3 Regional to lymph nodes |
| *EOD Primary Tumor* | 100 |
| *EOD Lymph Regional Nodes* | 200 |
| *EOD Mets* | 00 |
| Regional Nodes Positive | 02 |
| Regional Nodes Examined | 04 |
| Sentinel Lymph Nodes Positive | 02 |
| Sentinel Lymph Nodes Examined | 04 |
| Lymphovascular Invasion | 1 |
| SSDI’s |
| Lymph Nodes Positive Axillary Level I-II | 02 |
| ER Summary | 1 |
| ER Percent Positive | 091 |
| ER Allred Score | 08 |
| PR Summary | 1 |
| PR Percent Positive | 045 |
| PR Allred Score | 07 |
| HER2 Overall Summary | 0 |
| HER2 IHC Summary | 0 |
| HER2 ISH Summary | 1 |
| HER2 ISH Single Probe Copy No | XX.9 |
| HER2 ISH Dual Probe Copy No | XX.9 |
| HER2 ISH Dual Probe Ratio | XX.9 |
| Ki-67 (MIB-1) | 27.0 |
| Oncotype DX Recur Score | XX9 |
| Oncotype Dx Risk Level Invasive | 9 |
| Oncotype DX Recur Score - DCIS | XX6 |
| Oncotype Dx Risk Level - DCIS | 6 |
| Multigene Signature Method | 9 |
| Multigene Signature Result | 9 |
| Response Neoadjuv Therapy | 0 |
| Dx Staging and Treatement |
| Diagnostic Staging Procedure | 02 |
| Surgery of Primary Site | 22 |
| Scope of Regional Lymph Nodes | 2 |
| Surgical Procedure/Other Site | 0 |

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| Phase I Radiation |
| Phase I Primary Treatment Volume | **40** |
| Phase I to Draining Lymph Nodes | **04** |
| Phase I Treatment Modality | **02** |
| Phase I External Beam Planning Technique | **04** |
| Phase I Dose Per Fraction (cGy) | **00200** |
| Phase I Number of Fractions | **025** |
| Phase I Total Dose (cGy) | **05000** |
| Phase II Radiation |
| Phase II Primary Treatment Volume | **04** |
| Phase II to Draining Lymph Nodes | **88** |
| Phase II Treatment Modality | **02** |
| Phase II External Beam Planning Technique | **04** |
| Phase II Dose Per Fraction (cGy) | **00200** |
| Phase II Number of Fractions | **025** |
| Phase II Total Dose (cGy) | **005000** |
| Phase III Radiation |
| Phase III Primary Treatment Volume | **41** |
| Phase III to Draining Lymph Nodes | **00** |
| Phase III Treatment Modality | **04** |
| Phase III External Beam Planning Technique | **04** |
| Phase III Dose Per Fraction (cGy) | **00200** |
| Phase III Number of Fractions | **005** |
| Phase III Total Dose (cGy) | **001000** |
|  |
| Date RT Started | **5/27/19** |
| Date RT Ended | **7/9/19** |
| # of Phases of RT to this Volume | **03** |
| RT Discontinued Early | **01** |
| Total Dose | **006000** |

## BREAST CANCER CASE 3

75 y/o w/f, G0, h/o GERD, hyperlipemia, COPD, who presented w/ palpable LT breast lump. Pt reports noticing lump a couple of months ago and states she believes it’s been growing. Reports no pain associated with it. No nipple discharge, retraction or skin dimpling. Pt has extensive family history of breast cancer, with mother dx’d with breast cancer in her 60s. M-grandmother dx’d w/ breast cancer. Two daughters dx’d w/ breast cancer.

**Work-up Imaging**

Bilat MMG-TOMO/US: At site of palpable concern, 10:00 axis, there is a round, well demarcated lesion, measuring 2.1 x 1.5 x 0.9 cm. No dominant masses on RT breast. On ultrasound, lobular hypoechoic mass @ 10:00-11:00 position on LT breast, corresponding to MMG finding, measuring 2.3 x 1.4 x 0.8 cm. BIRADS 5: Highly suggestive of malignancy.

MRI breast bilat: On LT breast, irregular spiculated mass @ UOQ, measuring 2.5 x 1.4 x 1.1 cm. No LT axillary lymphadenopathy. No suspicious enhancement on RT breast.

**Biopsy**

6/17/19: 1. LT breast, @ 2:00, US-guided bx= Poorly differentiated invasive ductal carcinoma (tubule formation 3/3, nuclear pleomorphism 2/3, mitotic count 3/3), measuring 1.2 cm in maximal length in this material.

**Prognostic Indicator Markers**

Bx specimen Part #1:

ER= >95%, 3+. PR= 76-100%, 2-3+ HER2 IHC= 0, Negative Ki-67= 23%

**Surgery**

**6/27/19**: LT partial mastectomy with LT axillary sentinel lymph node biopsy.

Pathology Report

Procedure: LT breast lumpectomy, sentinel lymph node sampling,

Specimen laterality: Left

Tumor site: 10:00-11:00 axis

Tumor size: 1.9 cm

Histologic Grade: Nottingham Histologic Score:

* Tubular Differentiation: 3/3
* Nuclear Pleomorphism: 3/3
* Mitotic Count: 3/3
* Overall Grade: 9/9
* Grade 3

Tumor Focality: Unifocal

DCIS: present, minor component of tumor, solid & papillary, low nuclear grade. No necrosis.

Lymphovascular Invasion: Present

Margins uninvolved by invasive carcinoma.

Distance from closest margin (mm): All final margins >8 mm

Margins for DCIS: All negative, closest @ 2 mm

Regional lymph nodes: LT axillary sentinel lymph nodes

 Involved by tumor cells: 0

 Number of LNs with macrometastases (>2 mm): 0

 Number of LNs with micrometastases (>0.2 mm up to 2 mm and/or > 200 cells): 0

 1 Internal Mammary LN with ITCs.

Size of largest metastatic deposit (mm): None

Extranodal extension: None

Number of lymph nodes examined: 3

Number of sentinel lymph nodes examined: 2

Treatment effect in breast: No known prior treatment

**Surgical Immunohistochemistry Results**

ER= 89%, 3+ PR= 90%, 3+ HER2 IHC= 2+, Equivocal HER2 ISH: Not Amplified HER2 ratio= 1.3 AVG HER2 Copy #= 2.1 Ki-67= 20-30%

**Radiation Therapy Summary**

Patient received 5000 cGy to the LT breast tangents, RAO/LPO with 6X photons conformal plan. Additionally, the LT SCLA and axilla received 5000 cGy, 200 cGy in 25 fractions. The LT lumpectomy cavity was boosted with 6MV, 2 Gy x 8 fx. PAB boost: 1.8 Gy x 3 fx.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Txt Site | Energy – Modality | Dose/fx (cGy) | # fx | Total Dose (cGy) | Start Date | End Date |
| LT breast, RAO/LPO | 6X/Conformal | 200 | 25 | 5,000 | 7/15/19 | 8/16/19 |
| LT SCLV/Axilla | 6X/Conformal | 200 | 25 | 5,000 | 7/15/19 | 8/16/19 |
| LT Breast boost | 6X/Conformal | 180 | 5 | 900 | 8/19/19 | 8/23/19 |
| PAB boost | 6X/Conformal | 180 | 3 | 540 | 8/19/19 | 8/21/19 |

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| Scenario 3 |
| Primary Site | **C50.2** | Grade Clinical | 3 |
| Histology | 8500 | Grade Pathological | 3 |
| Behavior | 3 | Grade Post Therapy |  |
|  |
| Stage Data items |
| *Clinical Tumor Size* | *025* | *Pathological Tumor Size* | *019* | Tumor Size Summary | 019 |
| AJCC Stage |
| Clinical T | cT2 | Pathological T | pT1c | Post-therapy T |  |
| cT Suffix |  | pT Suffix |  | pT Suffix |  |
| Clinical N | cN0 | Pathological N | pN0 | Post-therapy N |  |
| cN Suffix |  | pN Suffix | (sn) | pN Suffix |  |
| Clinical M | cM0 | Pathological M | cM0 | Post-therapy M |  |
| Clinical Stage  | 2A | Pathological Stage | 1A | Post-therapy Stage |  |
| *Grade G3 Her 2 - ER + PR +* | *Grade G3 Her 2 - ER + PR +* | *Grade Her 2 ER PR* |
| Summary Stage 2018  | 1-Localized |
| *EOD Primary Tumor* | 100 |
| *EOD Lymph Regional Nodes* | 070 |
| *EOD Mets* | 00 |
| Regional Nodes Positive | 00 |
| Regional Nodes Examined | 03 |
| Sentinel Lymph Nodes Positive | 00 |
| Sentinel Lymph Nodes Examined | 03 |
| Lymphovascular Invasion | 1 |
| SSDI’s |
| Lymph Nodes Positive Axillary Level I-II | 00 |
| ER Summary | 1 |
| ER Percent Positive | 96 |
| ER Allred Score | 08 |
| PR Summary | 1 |
| PR Percent Positive | 090 |
| PR Allred Score | 1 |
| HER2 Overall Summary | 0 |
| HER2 IHC Summary | 2 |
| HER2 ISH Summary | 0 |
| HER2 ISH Single Probe Copy No | XX.9 |
| HER2 ISH Dual Probe Copy No | 2.1 |
| HER2 ISH Dual Probe Ratio | 1.3 |
| Ki-67 (MIB-1) | 20.1 |
| Oncotype DX Recur Score | XX9 |
| Oncotype Dx Risk Level Invasive | 9 |
| Oncotype DX Recur Score - DCIS | XX6 |
| Oncotype Dx Risk Level - DCIS | 6 |
| Multigene Signature Method | 9 |
| Multigene Signature Result | 9 |
| Response Neoadjuv Therapy | 0 |
| Dx Staging and Treatement |
| Diagnostic Staging Procedure | 02 |
| Surgery of Primary Site | 20 |
| Scope of Regional Lymph Nodes | 2 |
| Surgical Procedure/Other Site | 0 |

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| Phase I Radiation |
| Phase I Primary Treatment Volume | **40**  |
| Phase I to Draining Lymph Nodes | **04** |
| Phase I Treatment Modality | **02** |
| Phase I External Beam Planning Technique | **04** |
| Phase I Dose Per Fraction (cGy) | **00200** |
| Phase I Number of Fractions | **025** |
| Phase I Total Dose (cGy) | **005000** |
| Phase II Radiation |
| Phase II Primary Treatment Volume | **41** |
| Phase II to Draining Lymph Nodes | **00** |
| Phase II Treatment Modality | **02** |
| Phase II External Beam Planning Technique | **04** |
| Phase II Dose Per Fraction (cGy) | **00200** |
| Phase II Number of Fractions | **005** |
| Phase II Total Dose (cGy) | **001000** |
| Phase III Radiation |
| Phase III Primary Treatment Volume | **04** |
| Phase III to Draining Lymph Nodes | **88** |
| Phase III Treatment Modality | **02** |
| Phase III External Beam Planning Technique | **04** |
| Phase III Dose Per Fraction (cGy) | **00180** |
| Phase III Number of Fractions | **003** |
| Phase III Total Dose (cGy) | **000540** |
|  |
| Date RT Started | **7/15/19** |
| Date RT Ended | **8/23/19** |
| # of Phases of RT to this Volume | **03** |
| RT Discontinued Early | **01** |
| Total Dose | **006000** |