Second-look Ultrasound Findings after MRI and Pathologic Correlation

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Learning objectives

1. Review of Breast MRI indications.

Background

MRI has a high sensitivity for breast cancer and can detect lesions not seen initially on Mammogram or US.

However, due to its relative low specificity, histologic diagnosis is still required in suspicious findings. Prior to this, US is generally performed and this study is known as Second-Look US.

WHY SECOND-LOOK US AFTER MRI?:

- If there is an MRI finding, additional characterización of the lesion is possible with US.
- If needed, biopsy of the finding is cheaper, faster, more comfortable for the patient and more feasible under US.
- BUT: It is crucial that a correct MRI-US correlation is confirmed, especially to avoid false negative results and delay in cancer diagnosis.

BREAST MRI INDICATIONS:

1. Screening: (High-risk population whose lifetime risk of developing breast cancer is 20 to 80%):
   - BRCA-1 and BRCA-2.
   - First degree relatives of BRCA carriers not tested.
   - Mantle radiation to the chest prior to age 30.
• Other genetic abnormalities: Li-Fraumeny Syndrome, Peutz-Jeghers Syndrome, Cowden Syndrome.
• No recommendations for or against Screening MRI:

- Personal history of breast cancer.
- Previous high risk biopsies: ADH, LCIS, LAH.
- Dense breast (category III or IV).

2. Diagnostic:

• Axillary metastases of an unknown primary adenocarcinoma with Rx and US negative.
• To differentiate recurrence from post-surgical changes.
• To determine extent of disease and exclude contralateral cancer (controversial).
• As a problem-solving tool.
• To assess integrity of breast implants in symptomatic patients.

3. Therapeutic:

• To exclude residual disease after a surgery with positive margins.
• MRI is generally done prior to chemotherapy and after the first cycles to assess treatment response in patients with locally advanced cancer.

MRI / SECOND-LOOK US CORRELATION:

1. Location:

• Breast, quadrant, clock position and distance to nipple.
• Distance to lateral or medial wall, seems to be more variable because of the difference in position between both modalities (prone vs supine).

2. Shape:

• If there is a mass the correlation is generally good.
• If there is a NLME the US finding may correspond to DCIS following a ductal distribution and the correlation can be hard.

3. Size:
• May be some variation due to areas of enhancement on MRI that become isoechoic on US.
• The larger lesion, the more likely to be seen on US.
• Foci are usually NOT seen on US.

4. Depth:

• Can vary due to difference in position between both modalities.
• That variation is less significant in lesions that are central or close to the nipple and in small breasts.

Findings and procedure details

CASE 1:

• 57 year-old female presented for annual screening.
• Previous mammography (2010) with an asymmetry in the superior quadrant Fig. 1 on page 9 that disappeared in the localized compression Fig. 2 on page 11 and without ultrasound counterpart suggested fibroglandular tissue.
• The present mammogram showed the asymmetry more evident than previous and then MRI was performed. Fig. 3 on page 11.
• The MRI showed a suspicious non mass enhancement (NME) close to the 12 o`clock position. Fig. 4 on page 13, Fig. 5 on page 13.
• The second-look US showed an irregular, hypoechoic area, ill defined but close to the chest wall and surrounded by fatty tissue. The core biopsy was performed over this area and a marker was deployed. Fig. 6 on page 14.
• The mammogram showed the marker over the asymmetry, which indicated that the biopsy was performed over the right place. Fig. 7 on page 15.

Core Biospsy: Ductal carcinoma in situ.

Differential Diagnosis: Lobular carcinoma, Psedoangiomatous stromal hyperplasia, invasive ductal carcinoma.
Tip: In case of NME or doubts of US-correlation it is recommended to mark the biopsy place and posteriorly confirm with MRI or a mammography (as in this case) that the biopsy was performed over the right lesion.

CASE 2:

- 67 year-old female presented for non-cyclical pain on the left.
- Personal history: Bilateral augmentation mammoplasty and family history of breast cancer.
- Mammogram, US and MRI were performed.
- The mammogram and US were negative.
- MRI showed a small lesion in the 1 o´clock position, 4,3 cm from anterior skin at the fat-parenchyma interface. Fig. 8 on page 17, Fig. 9 on page 17.
- 2nd look US confirmed a 7 mm oval, isoechoic mass in the 12 o’clock position with no posterior acoustic features and partially ill-defined. Though it lies 1.7 cm from anterior skin, in both studies the mass lies at the premammary-fat interface. Fig. 10 on page 17.

Core Biopsy: *Invasive ductal carcinoma grade 1.*

Differential Diagnosis: Carcinoma, Fibroadenoma, Papilloma, Focal Fibrosis.

Tip: The difference in the depth of a lesion between both modalities can happen especially in the AP place due to difference in patient position in both studies.

CASE 3:

- 43 year-old female presented for annual screening, BRCA +.
- Personal history: Right conservative surgery for carcinoma and augmentation mammoplasty. Previous traffic accident with trauma over the chest wall corresponding to the seat belt region.
• MRI showed an intact implant without complications and an intercostal enhancing smoothly marginated homogeneous mass posterior to the implant. Fig. 11 on page 18, Fig. 12 on page 19.

• US showed the implant and a posterior hypoechoic mass. Fig. 13 on page 20.

**FNA:** Negative for malignancy. Stromal fragments without epithelial cells (H&E, x20). Fig. 15 on page 22

**Differential Diagnosis:** Breast recurrence, breast metastases, soft tissue tumors.

**Tip:** In patients with implants biopsies may be more complicated to perform, so:

• If the lesion is located anterior to the pectoral muscle you have to take care of the implant. You can inject anaesthetic between the lesion and the implant so the lesion moves forward.

• If the lesion is located posterior to the pectoral muscle you can push the implant back (similar to Eklund technique) to reach the lesion. Fig. 14 on page 21

**CASE 4:**

• 47 year-old female that presented for pre-surgical assessment after having been diagnosed with IDC in the right breast. Fig. 16 on page 23.

• MRI showed the IDC (ill-defined rim enhancing mass with central necrosis) Fig. 17 on page 24 and another ill defined enhancing mass in the ipsilateral axillary tail Fig. 18 on page 25 (slightly superior to the previous and confirmed one). It showed also an axillary axillary lymph node with fatty hilum but with a prominent cortex Fig. 19 on page 26.

• Second-look US showed an irregular hypoechoic mass with posterior acoustic shadowing in the posterior axillary tail Fig. 20 on page 27 and a lymph node with an irregular cortex Fig. 21 on page 28.

• A Vacuum - Assisted Core Biopsy of the second lesion was made with a ILC result. Fig. 22 on page 29.

• An FNA of the lymph node was made with a metastatic result.
Vacuum-Assisted Core Biopsy: *ILC, grade 2*. Non cohesive atypical cells growing in solid and with an indian file pattern (H&E, 20x)

**Tip:**

- Keep looking when you find a lesion as multicentricity likely changes patient management!
- Remember that you can find two different types of cancer in the same patient like in this case (IDC and ILC).
- Use the already known lesion as a landmark.

**CASE 5:**

- 56 year-old female with previous right mastectomy and reconstruction with silicone implant.
- She presented with a new palpable mass in RLOQ.
- US showed an irregular isoechoic mass wider than tall that was biopsied and IDC was confirmed. Fig. 23 on page 30.
- Pre-surgical MRI was done showing the index lesion corresponding in size and location Fig. 24 on page 31 and an additional 9 mm ill-defined mass in the RLOQ also adjacent to the implant with rapid enhancement and washout Fig. 25 on page 32.
- Second-look US confirmed an ill-defined isoechoic focal area (this was hard to identify in another plane) in the RLOQ Fig. 26 on page 33.

**Core Biopsy:** *IDC*. Fig. 27 on page 34.

**Differential diagnosis:** FN vs Recurrence, both can be palpable.

**Tip:** Sometimes Second - Look US findings are very subtle and hard to identify in two planes. Do not dismiss them if it correlates with a suspicious MRI finding, specially if is palpable!

**CASE 6:**
• 42 year-old female with previous right mastectomy and flap reconstruction that presented for a new palpable mass on the right.

• Mammogram was reported as negative.

• US showed 2 simple cysts. Fig. 28 on page 35.

• MRI showed two hyperintense retroareolar masses on T1 Fig. 29 on page 36, hypointense on T2 Fig. 30 on page 37, with no contrast enhancement corresponding to the cysts of the US, demonstrating that they were not simple cysts but a oil cysts.

• On the MRI there was also a posterior 7 mm hypointense mass on T1 and T2 that enhanced rapidly, adjacent to the pectoral muscle Fig. 31 on page 38.

• Second-Look US confirmed an ill-defined 7 mm hypoechoic mass in the posterior region, posterior to the oil cysts Fig. 32 on page 39.

• Reviewing the patient’s Mammogram, it showed the oil cysts in the palpable region Fig. 33 on page 39.

FNA: Negative for malignant cells, probably fat necrosis.

Tip:

• Always look at all the patient’s previous studies.
• Depending on the stage, fat necrosis may enhance or not, and if so it can mimic a carcinoma. On US it can range from hypoechoic to anechoic lesions.
• Take into account any possible landmarks such as the pectoral muscle shown in this case.

CASE 7:

• 59 year-old female BRCA+ with bilateral augmentation mammoplasty.

• On Mammogram some pleomorphic calcifications were noted and a biopsy was performed with a IDC.

• An MRI was performed showing a NME with a ductal distribution in UOQ with rapid enhancement corresponding to the area of microcalcifications on Mammogram. There was also an additional rim enhancing mass in the retroareolar region Fig. 34 on page 40, anterior to the implant, that was
hyperintense on T2 and that was thought to be an inflamed cyst Fig. 35 on page 41.

- On Second-Look US there was a bilobed anechoic lesion Fig. 36 on page 42. This finding and the rim enhancing on the MRI suggested the biopsy.

**Core biopsy** of the microcalcifications and of the area with the cyst-like lesions: IDC grade 2. Groups of atypical infiltrative cells with tubular and solid patterns (H & E, 10x).

**Tip:** Although hyperintensity on T2 is a sign of a cystic lesion, this does not rule out malignancy as it can also be seen in some carcinomas such as mucinous and cysts can be in the midst of a carcinoma.

**Images for this section:**
Fig. 1: 2010 Mammography: Asymmetry in the superior quadrants.

Fig. 2: Localized compression: Dissociation of the asymmetry.
**Fig. 3:** 2014 Mammography: Asymmetry more evident than in previous mammographies but without us correlation.

**Fig. 4:** MRI: Subtracted image after IVC showing a suspicious NMLE in the UQ.
Fig. 5: Sagittal reconstruction showing the NMLE in the superior quadrant.
Fig. 6: Second-look US: Irregular hypoechoic area, ill-defined, that corresponds to the enhancement in the MRI, close to the chest wall and surrounded by fatty tissue.
**Fig. 7:** Mammography performed after the biopsy. The marker proves the coincidence between the asymmetry and the area that has been biopsed.

**Fig. 8:** Coronal T1 showed a hypo intense mass in the right breast centrally.

**Fig. 9:** Axial first subtraction confirmed a 7 mm oval enhancing mass in the 1 o’clock position, 4.3 cm from anterior skin at the fat parenchyma interface.
Fig. 10: Second-look US: 7 mm oval, isoechoic mass in the 12 o’clock position and partially ill-defined. Though it lies 1,7 cm from anterior skin, in both studies the mass lies at the premammary - fat interface.
**Fig. 11:** MRI: Intercostal enhancing, posterior to the pectoral muscle and implant. The cytology is needed because of the personal history of breast cancer.
Fig. 12: MRI: Sagittal reconstruction
Fig. 13: Second-look US: Hypoechoic mass located posterior to the implant and between two costal arches corresponding to the MRI lesion. The location makes difficult the biopsy or FNA.
Fig. 14: US-guided FNA: We displaced the implant pushing it back (similar to Eklund technique) to be able to reach the lesion.
Fig. 15: Cytology: Negative for malignancy. Stromal fragments without epithelial cells. (H&E, 20x)
**Fig. 16:** US: Irregular hypoechoic mass corresponding to the already know IDC.
Fig. 17: MRI: Axial first subtraction image showing an ill-defined rim enhancing mass with central necrosis.
Fig. 18: MRI: Axial subtraction slightly more superior to the previous image. A second ill-defined enhancing mass in the ipsilateral axillary tail is showed.
Fig. 19: MRI: Axial T1 demonstrate an axillary lymph node with a prominent cortex.
Fig. 20: Second-look US: Irregular hypoechoic mass with posterior acoustic shadowing in the axillary tail, with different aspect than the main an confirmed lesion.
Fig. 21: Second-look US: Lymph node with fatty hilum but with a thick cortex. The FNA confirmed metastatic node.
**Fig. 22:** Vacuum-Assisted Core Biopsy: ILC grade 2. Non-cohesive atypical cells growing in solid and indian files patterns (H&E, 20x).
**Fig. 23:** US focused on the palpable lesion: Irregular isoechoic mass wider than tall measuring 15 x 7 mm that was biopsed and IDC was confirmed.
Fig. 24: Presurgical MRI: Subtracted image showing the index lesion.
Fig. 25: Presurgical MRI: Subtracted image showing an additional 9 mm ill-defined mass in the RLOQ that was suspicious of multicentric disease.
Fig. 26: Second-Look US: Ill-defined isoechoic focal area in the RLOQ. This image was hard to identify in another plane.
Fig. 27: Mastectomy: IDC with multiple groups of atypical epithelial cells infiltrating fibrous stroma (H&E, 20x).
**Fig. 28:** US showed two anechoic lesions corresponding to the palpable area, with simple cystic appearance.
**Fig. 29:** MRI: Axial T1 image showed a hyperintense lesion corresponding to the palpable area.
Fig. 30: MRI: Axial T2 image showed a hypointense lesion corresponding to the palpable area.
Fig. 31: MRI: The subtracted image showed no enhancement of the lesion visualized on T1 and T2, corresponding to the palpable lesion and to the US cystic appearance lesion, demonstrating that it was an oil cyst. However there was a posterior ill-defined 7 mm lesion that enhanced rapidly.

Fig. 32: Second-Look US: Ill-defined 7 mm hypoechoic mass in the posterior central region, adjacent to the pectoral muscle and posterior to the oil cysts. The FNA were negative for malignancy, probably fat necrosis.
**Fig. 33:** Mammogram previous to the US and MRI was not completely negative, showing the 2 oil cysts.
Conclusion

- Second-Look US should be performed with all the patients’ previous studies available as well as clinical correlation.
- It requires careful MRI-US correlation taking into account size, location, shape and level of suspicion of the finding.
- Many of the suspicious MRI masses with US correlation are invasive carcinomas.
- In the high-risk population subtle findings are more common as well as benign-appearing masses that can represent high grade carcinomas. Thus histology is still recommended.
- Most of the MRI findings without an US correlation are benign.
- A focus is hard to find and correlate on US so Second-Look US is rarely performed.

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