



Correlation between MRI & biopsies under second look Ultrasound

Anne de Roquancourt, Service d'anatomopathologie

Cédric de Bazelaire, Service de radiologie

Hôpital Saint-Louis - Paris

Introduction

Correlation between MRI & biopsies under second look US

CMS Saint-Louis

- ▶ Retrospective study
 - ▶ 100 patients
 - ▶ 2008 – 2009
 - ▶ 2nd look US + Biopsy
 - ▶ Follow-up 2-4 years

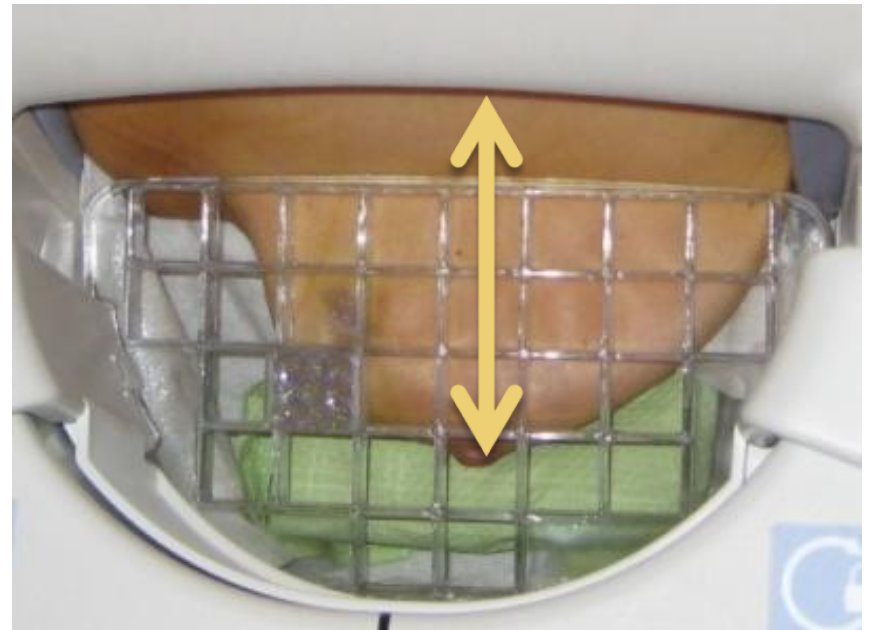
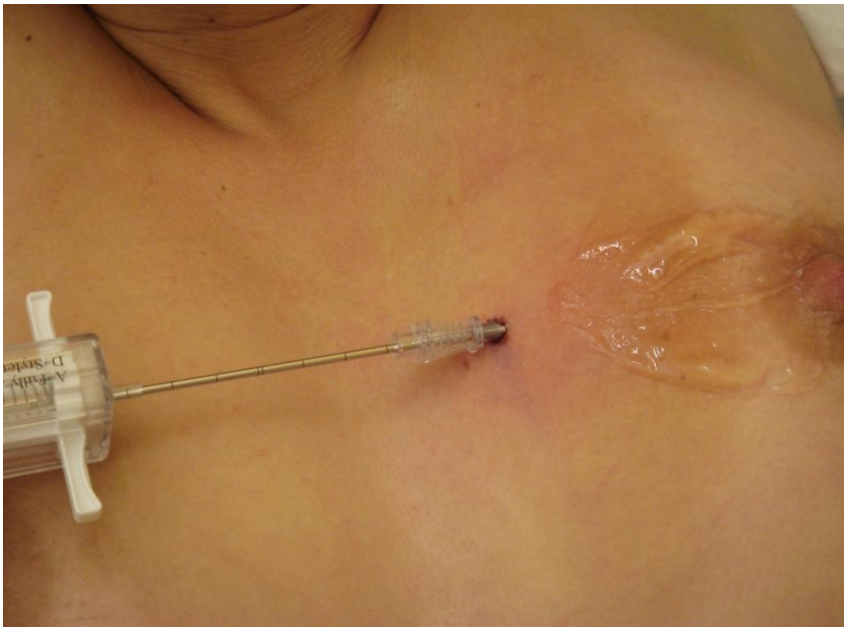


Displacement ?

Correlation between MRI & biopsies under second look US

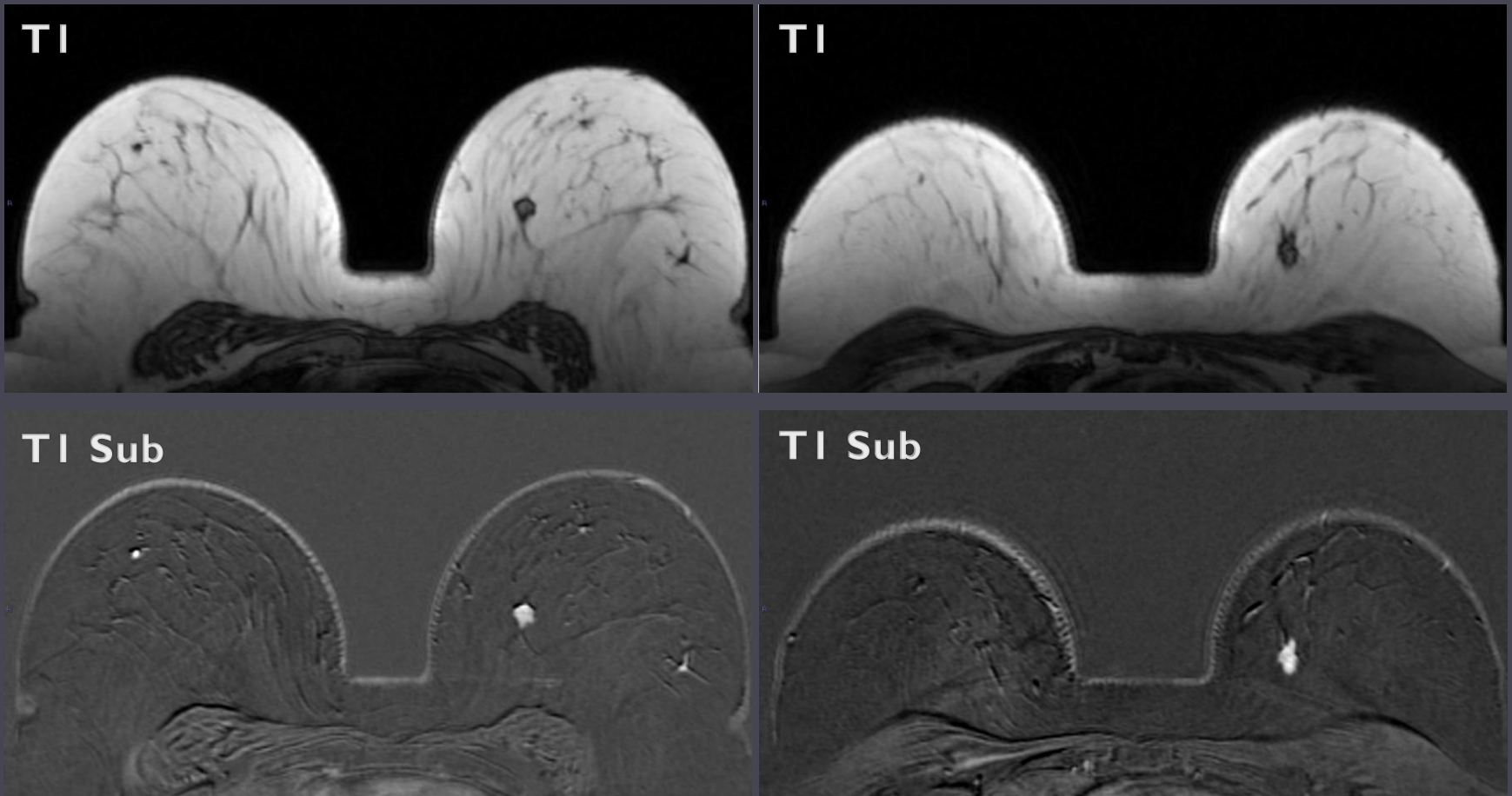
Switch MRI → Ultrasound

- ▶ Displacement of the target
 - ▶ High in anterior-posterior axis: 30 à 60 mm^l (K=0.55)
 - ▶ Moderate in other axis : 10 mm^l



Displacement

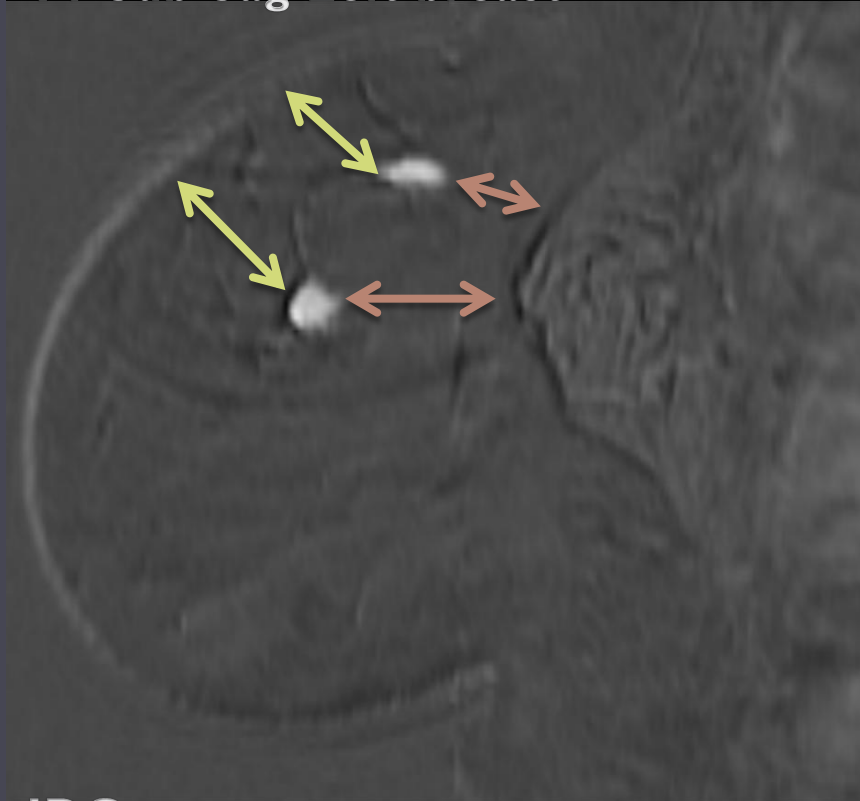
Breast cancer history, new microcalcifications of the left lower External Quadrant BIRADS 4.



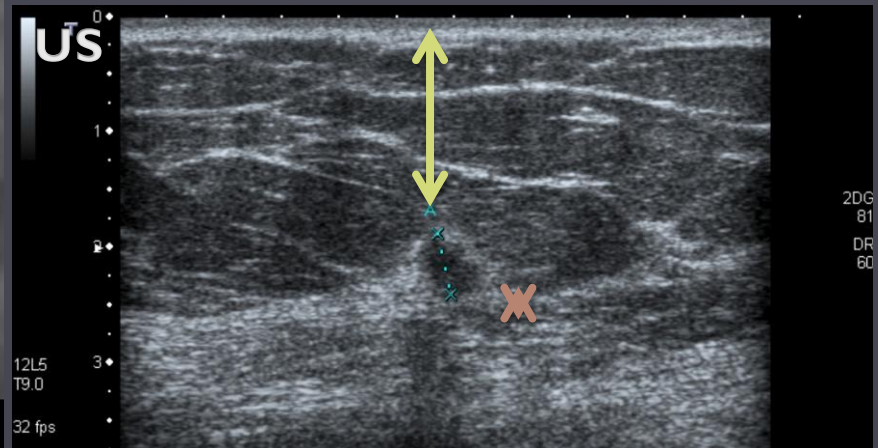
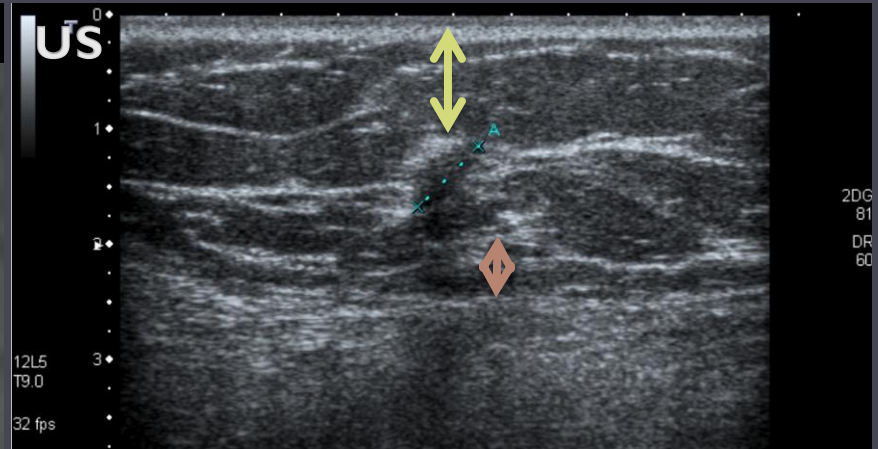
Displacement

MPR provides good showing of the distances between the lesion and the skin/muscle/scar

TI Sub Sag Left breast



IDC

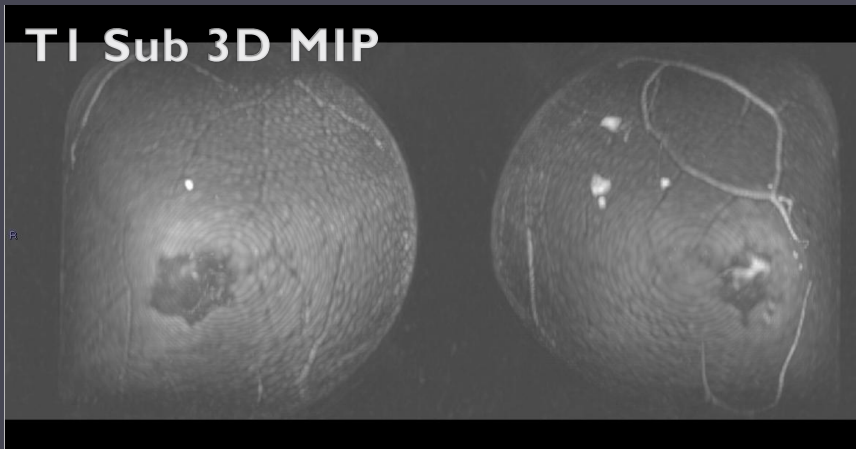


Agreement between MRI and US

- ▶ Location of the target
 - ▶ Anterior/posterior displacement
 - ▶ Fisher, $p=0.55$
 - ▶ Cranio caudal displacement
 - ▶ Quadrant Superior/lower: $\text{Kappa}=0.97$
 - ▶ Lateral displacement
 - ▶ Quadrant Internal/External : $\text{Kappa}=0.93$
 - ▶ The hour topography
 - ▶ $\text{Kappa}=0.52$

Displacement

MIP provides good showing of the location of the lesions

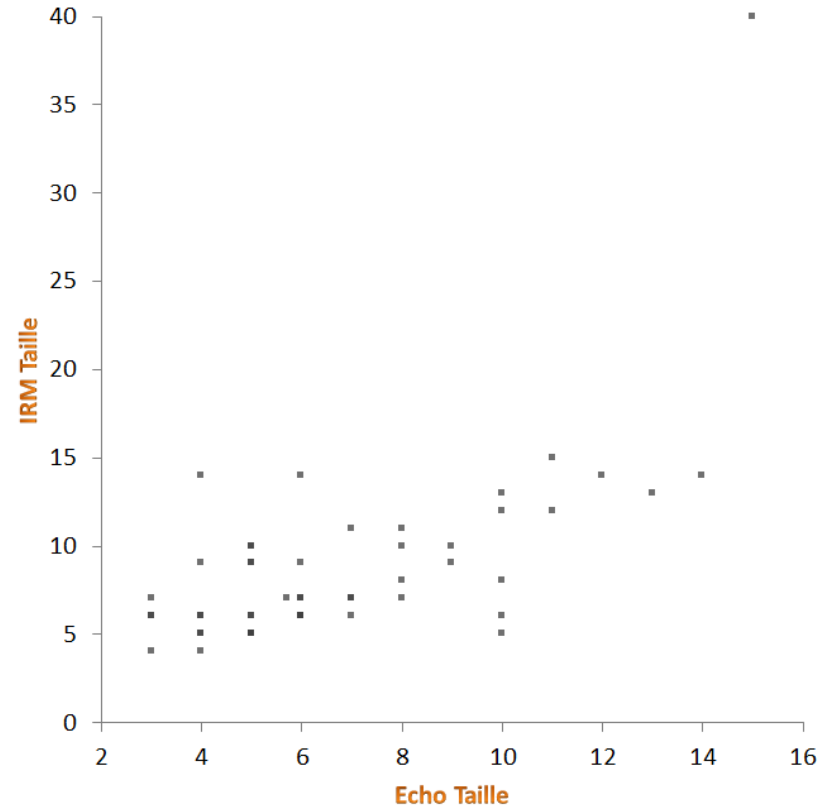


Morphological findings

Correlation between MRI & biopsies under second look US

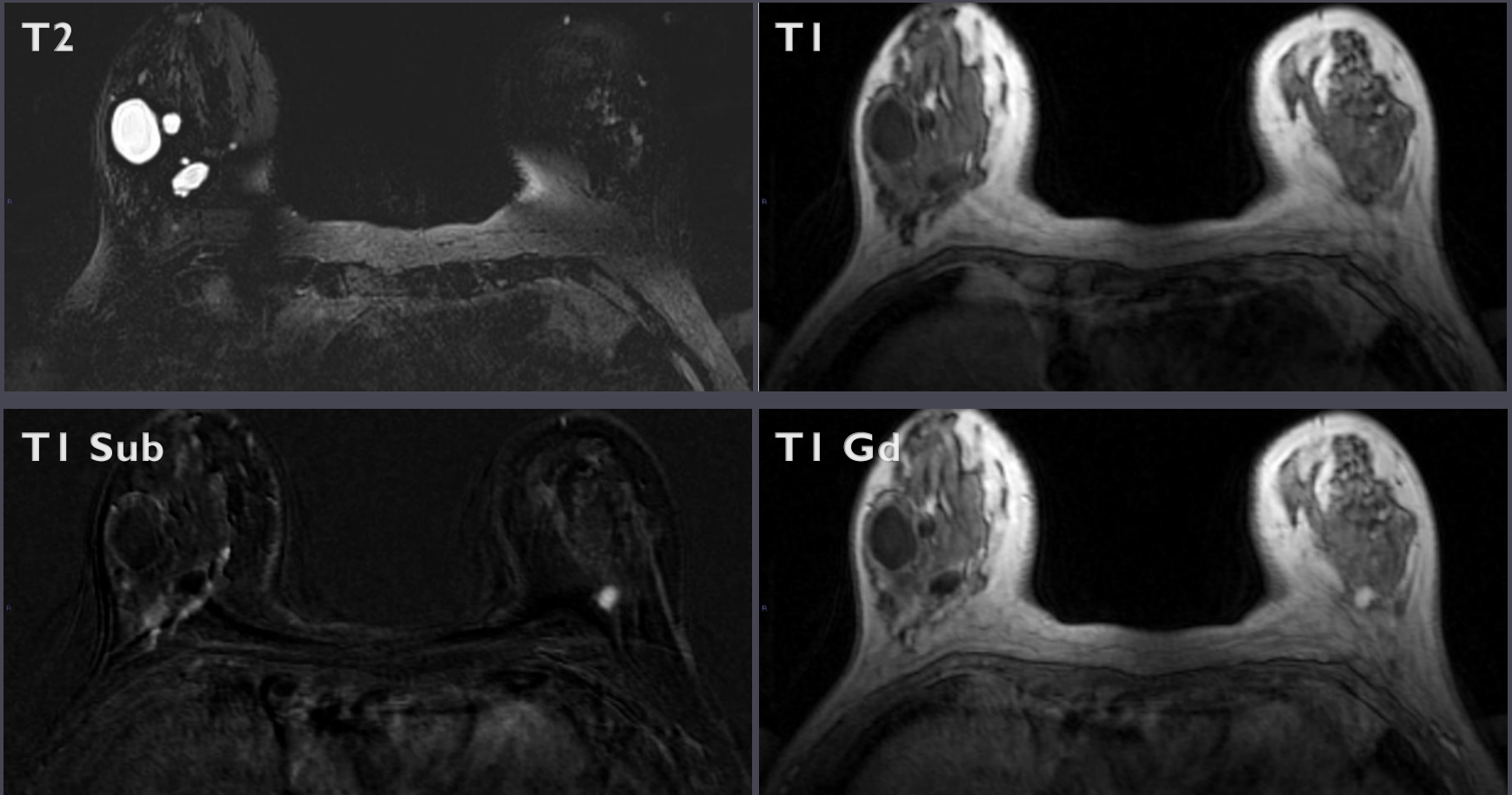
Agreement between MRI and US

- ▶ Morphological findings
 - ▶ Shape: benign vs suspicious
 - ▶ $\text{Kappa}=0.09$
 - ▶ Margin: benign vs suspicious
 - ▶ $\text{Kappa}=0.23$
 - ▶ Size
 - ▶ T-test, $p=0.0001$
- ▶ BIRADS 3 vs 4 & 5
 - ▶ $\text{Kappa}=0.11$



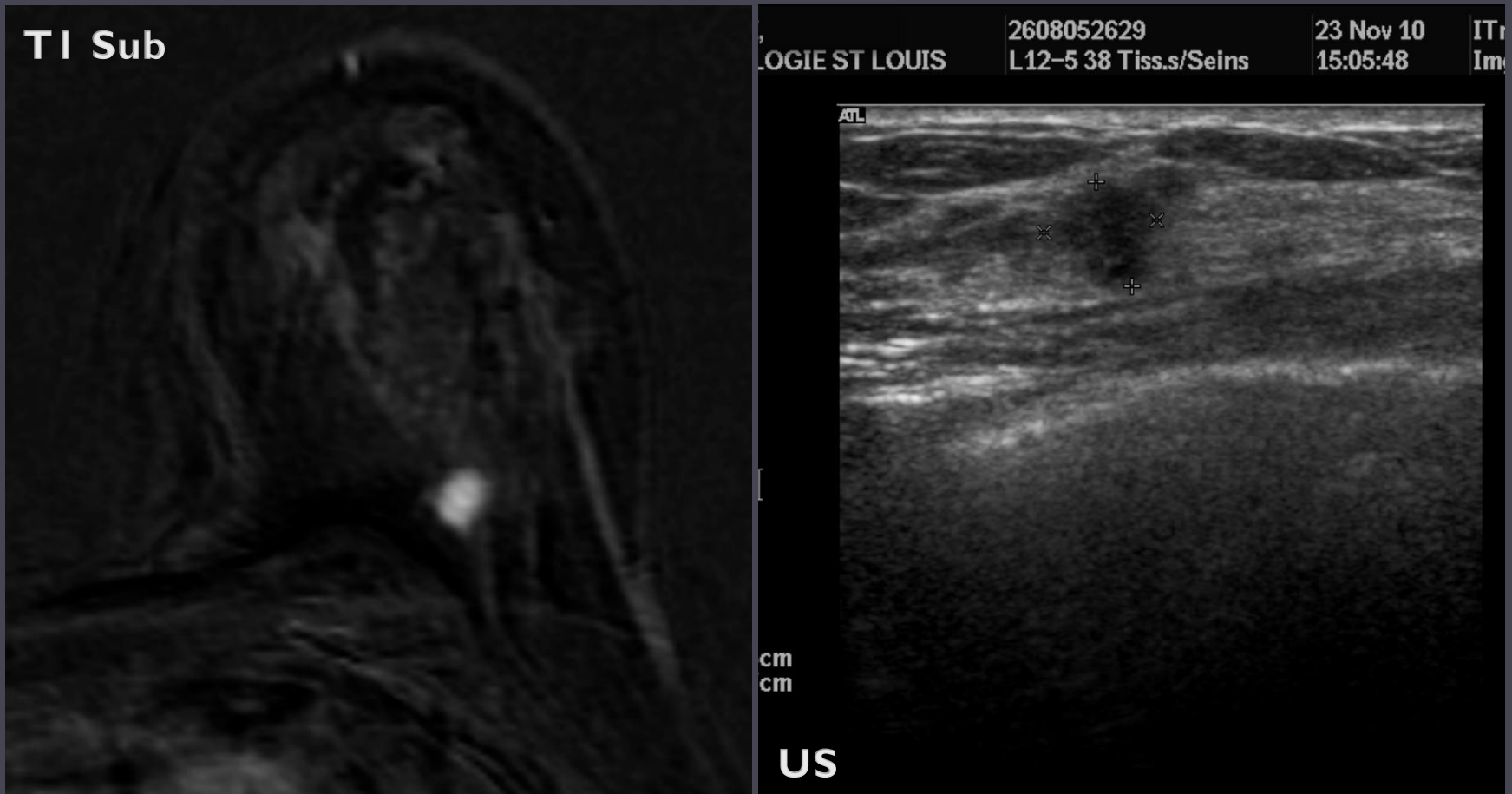
Agreement between MRI and US: morphological findings

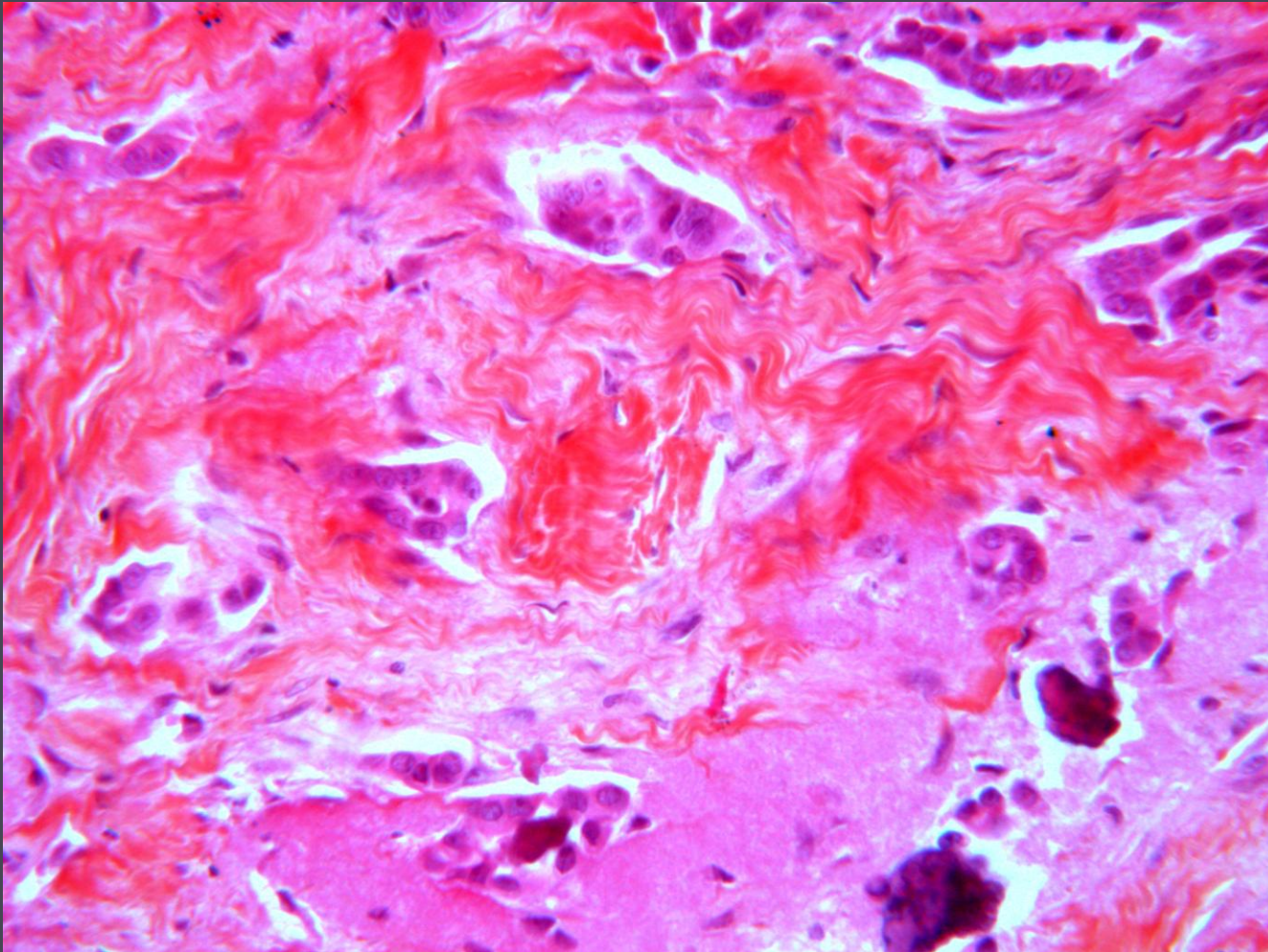
46 yo, history of breast cancer



Agreement between MRI and US: morphological findings

46 yo, history of breast cancer





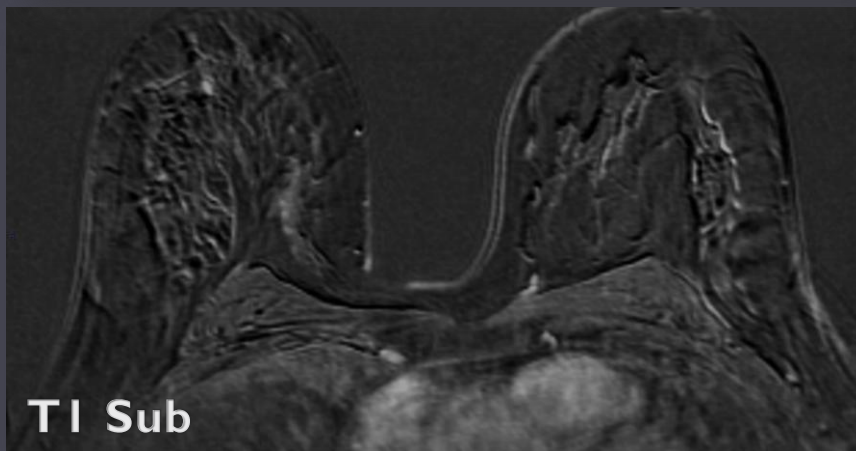
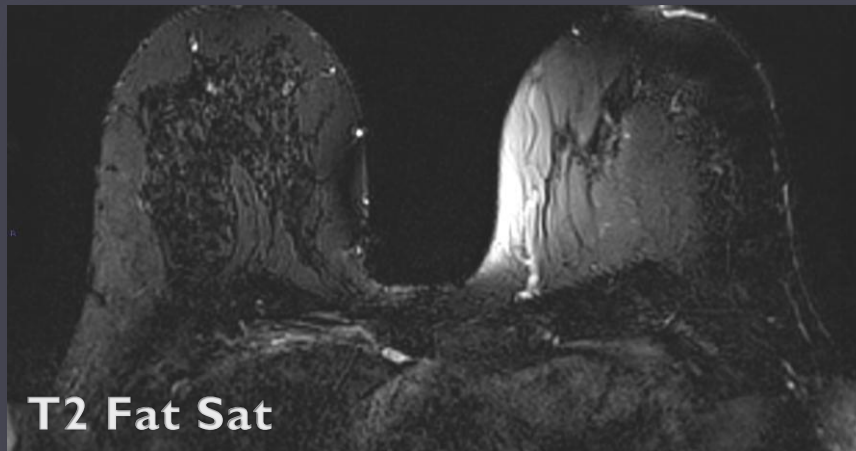
IDC
SBR grade I

Succes rate according morphological findings

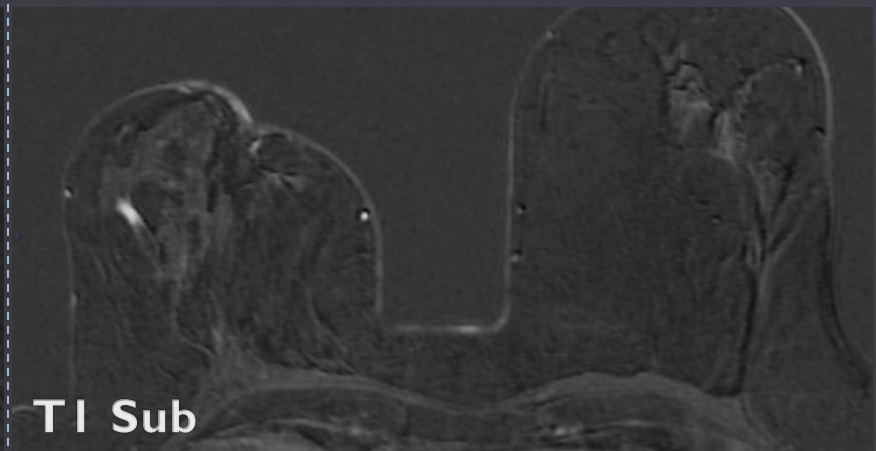
Correlation between MRI & biopsies under second look US

Success rate of second look US: Mass versus non-mass

60 yo, staging of ILC of the right breast

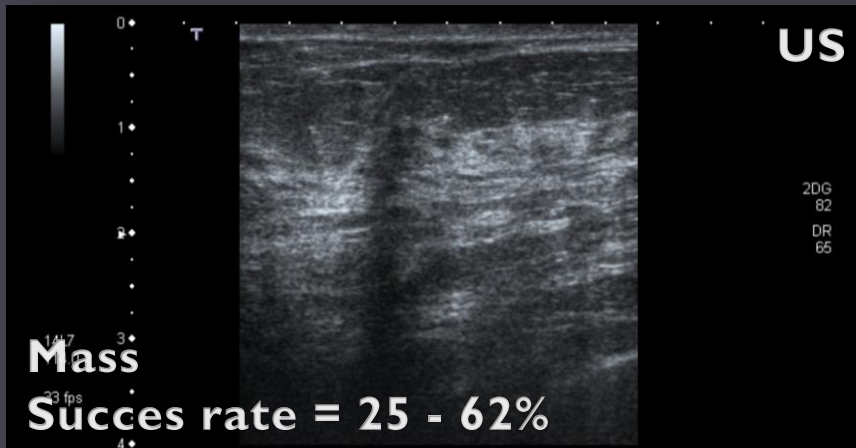
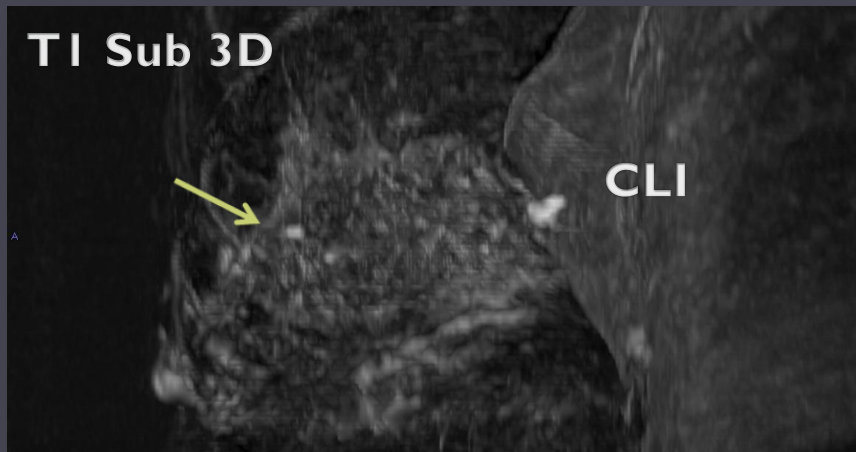


63 yo, history of breast cancer, follow-up

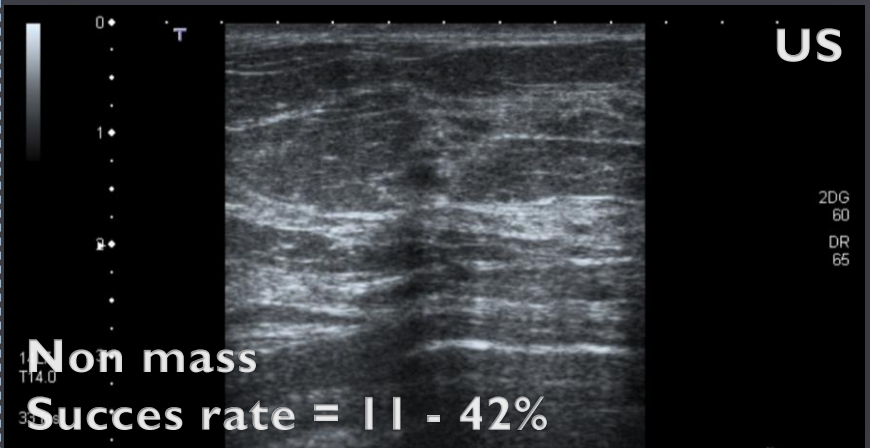
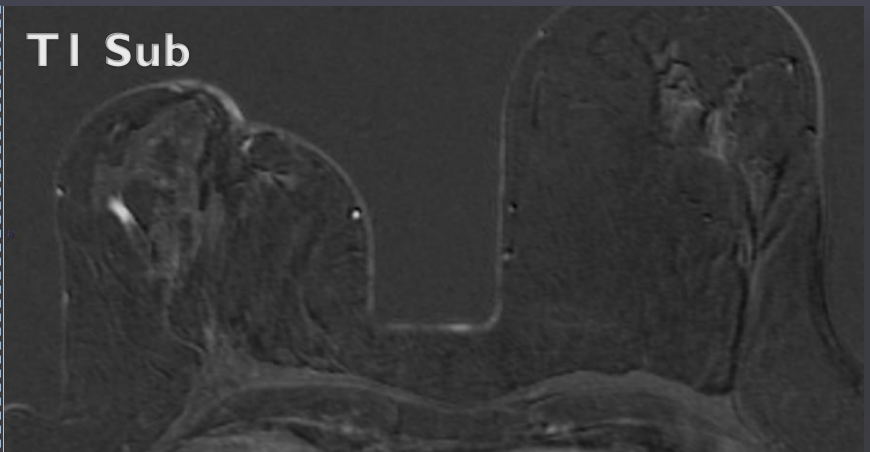


Success rate of second look US: Mass versus non-mass

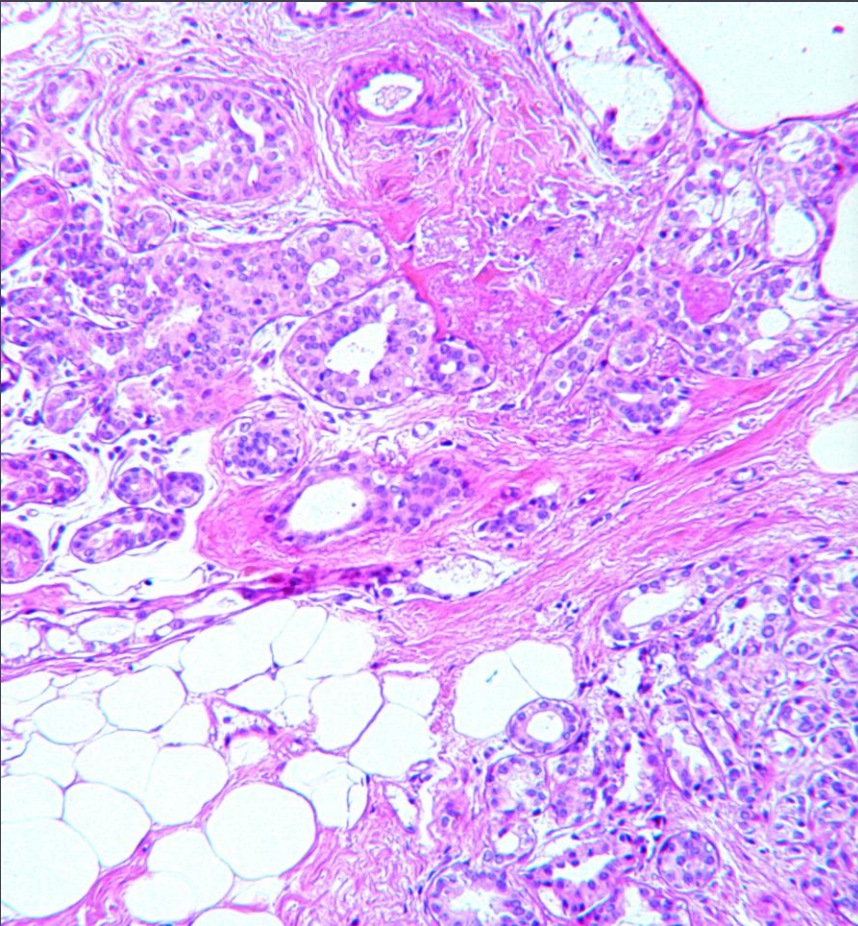
60 yo, staging of ILC of the right breast



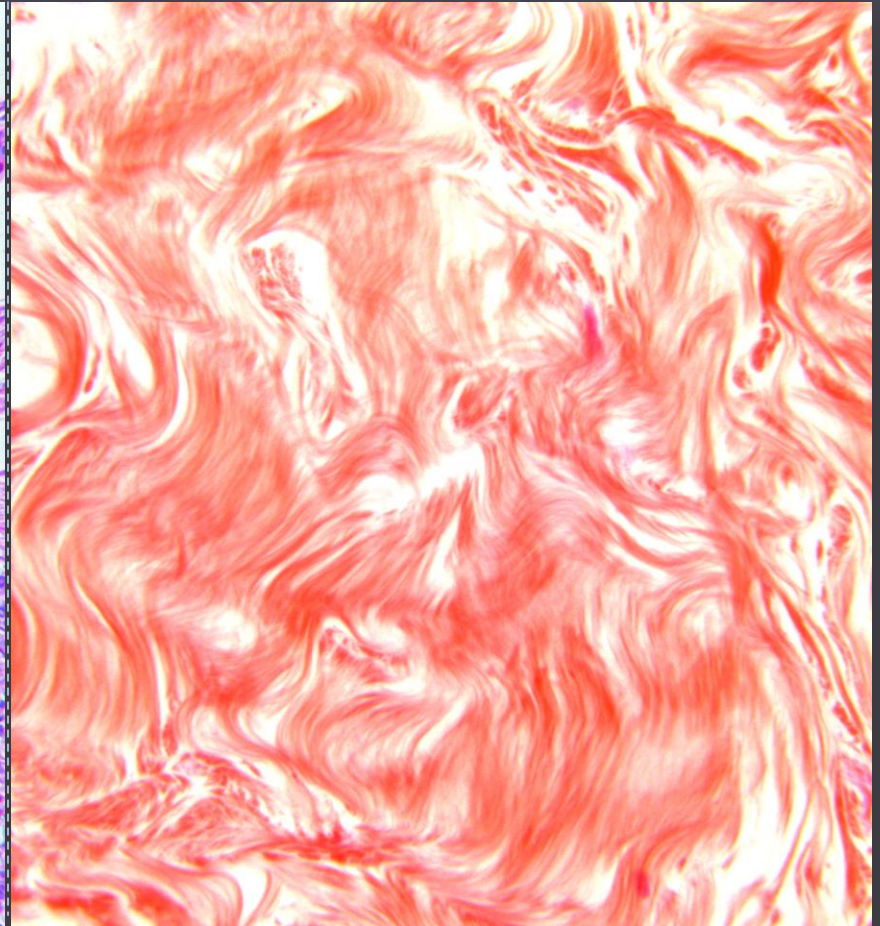
63 yo, history of breast cancer, follow-up



Dystrophy: adenosis



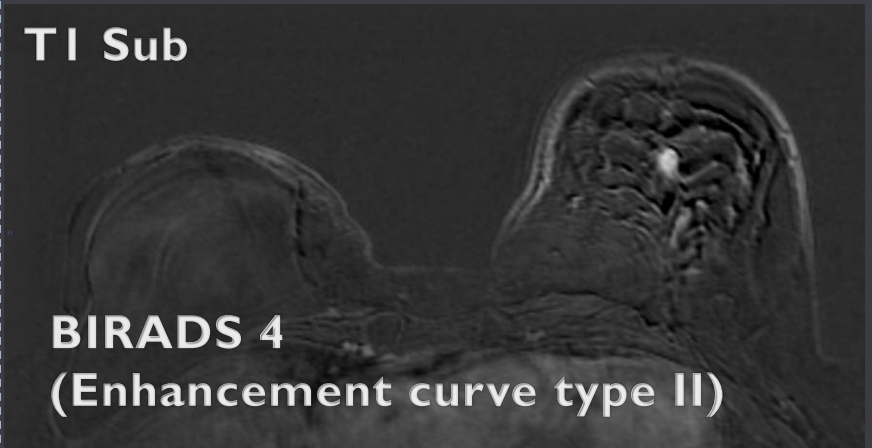
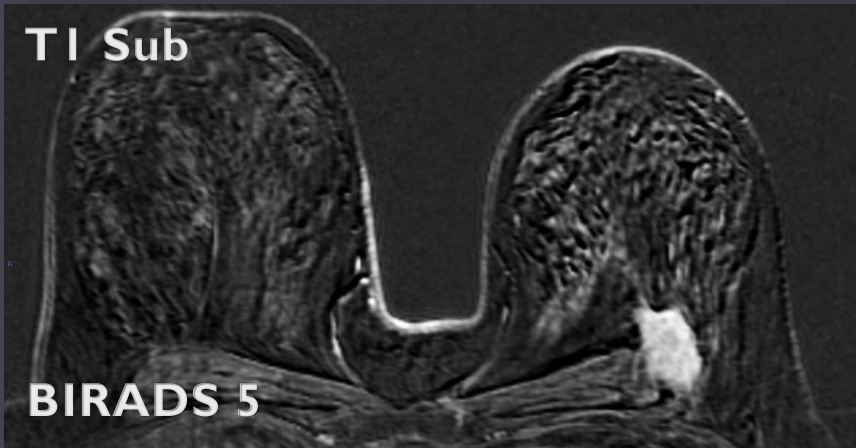
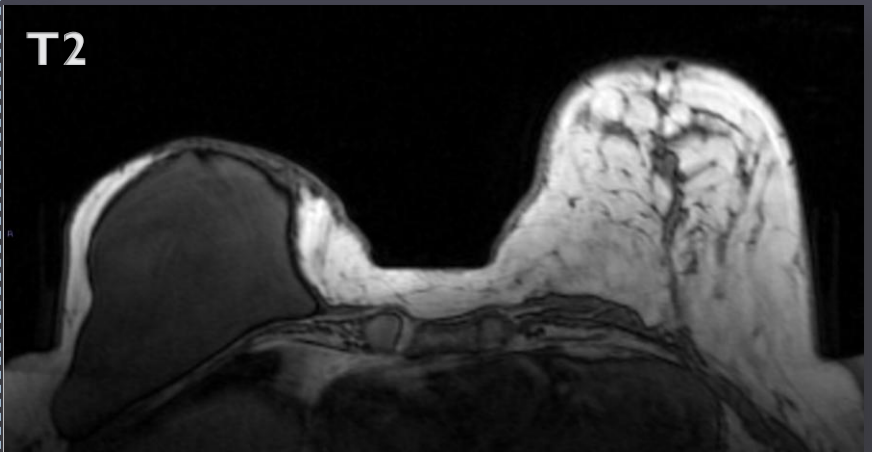
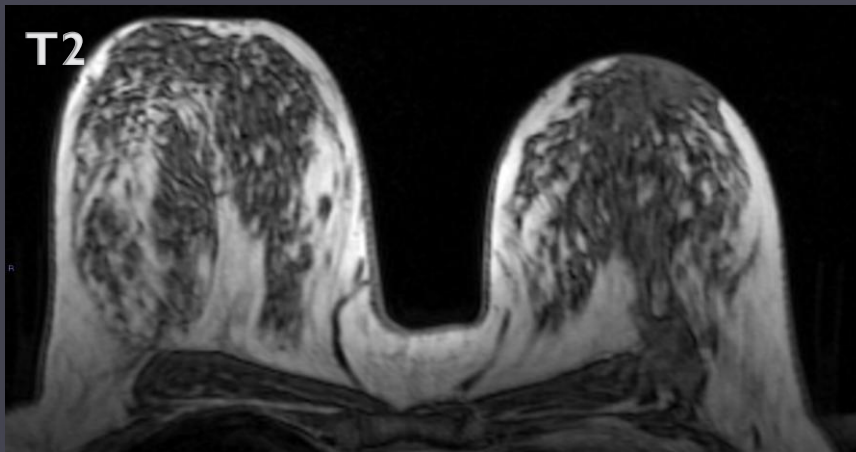
Scar sclerosis



Success rate of second look US: Suspicious versus benign

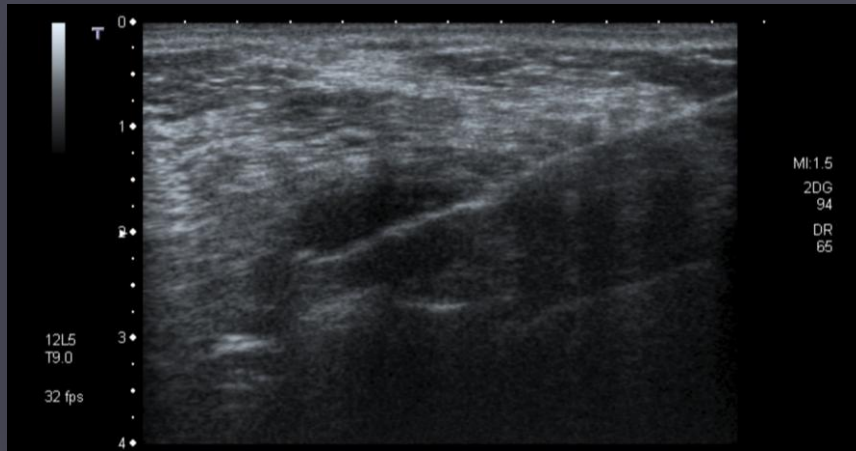
60 yo, left nipple retraction

57 yo, history of breast cancer, lymph nodes in left axilla

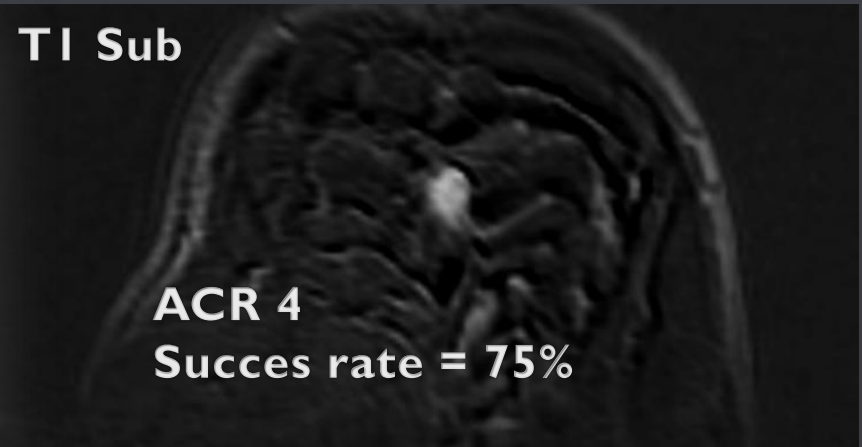
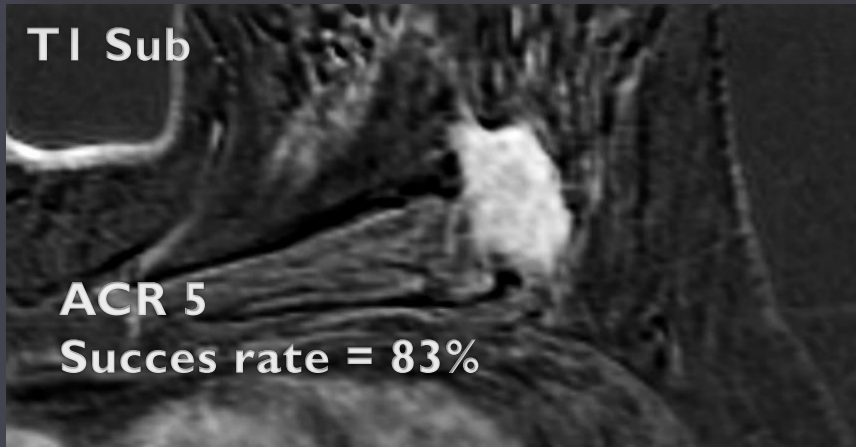
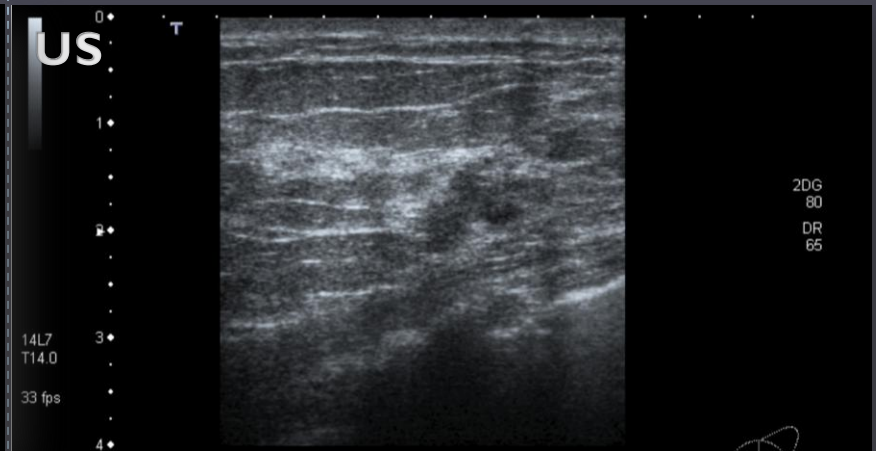


Success rate of second look US: Suspicious versus benign

60 yo, left nipple retraction

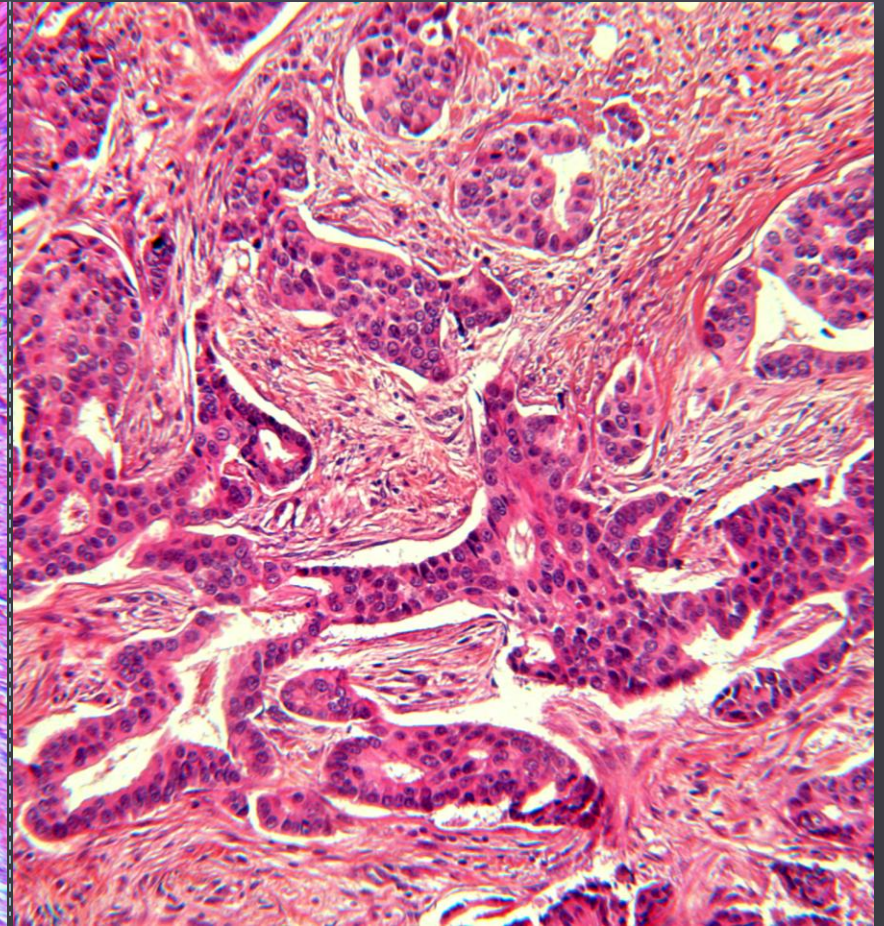
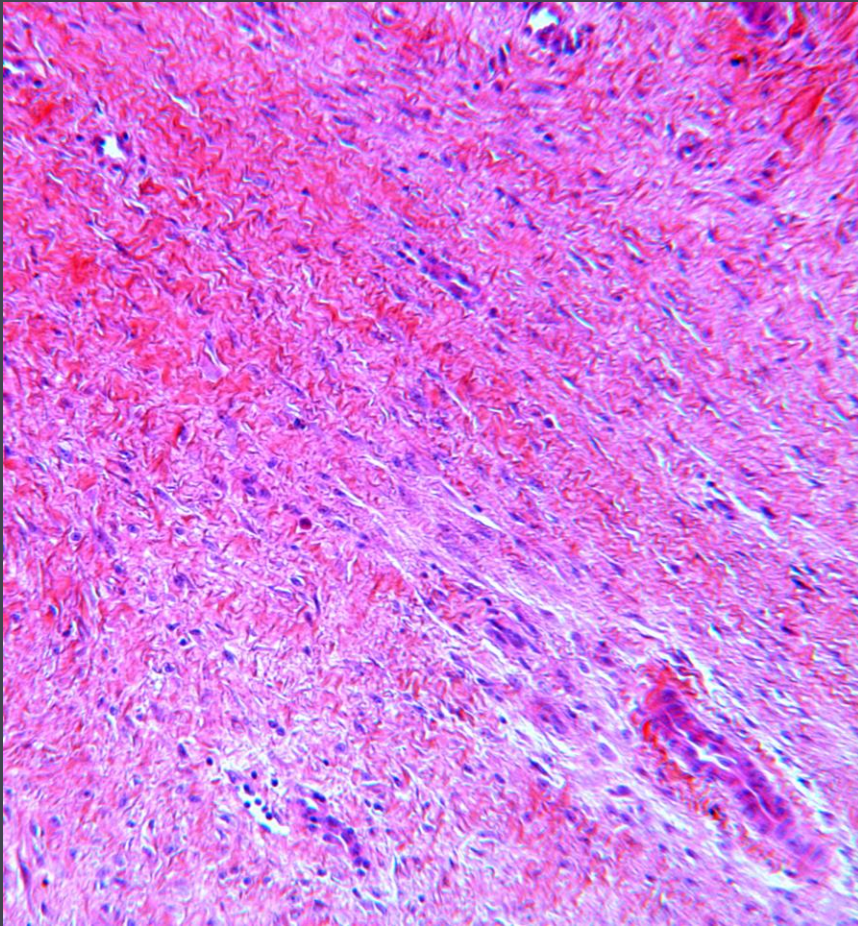


57 yo, history of breast cancer, lymph nodes in left axilla



Desmoïde fibroma

IDC, SBR grade II



Success rate according to the size

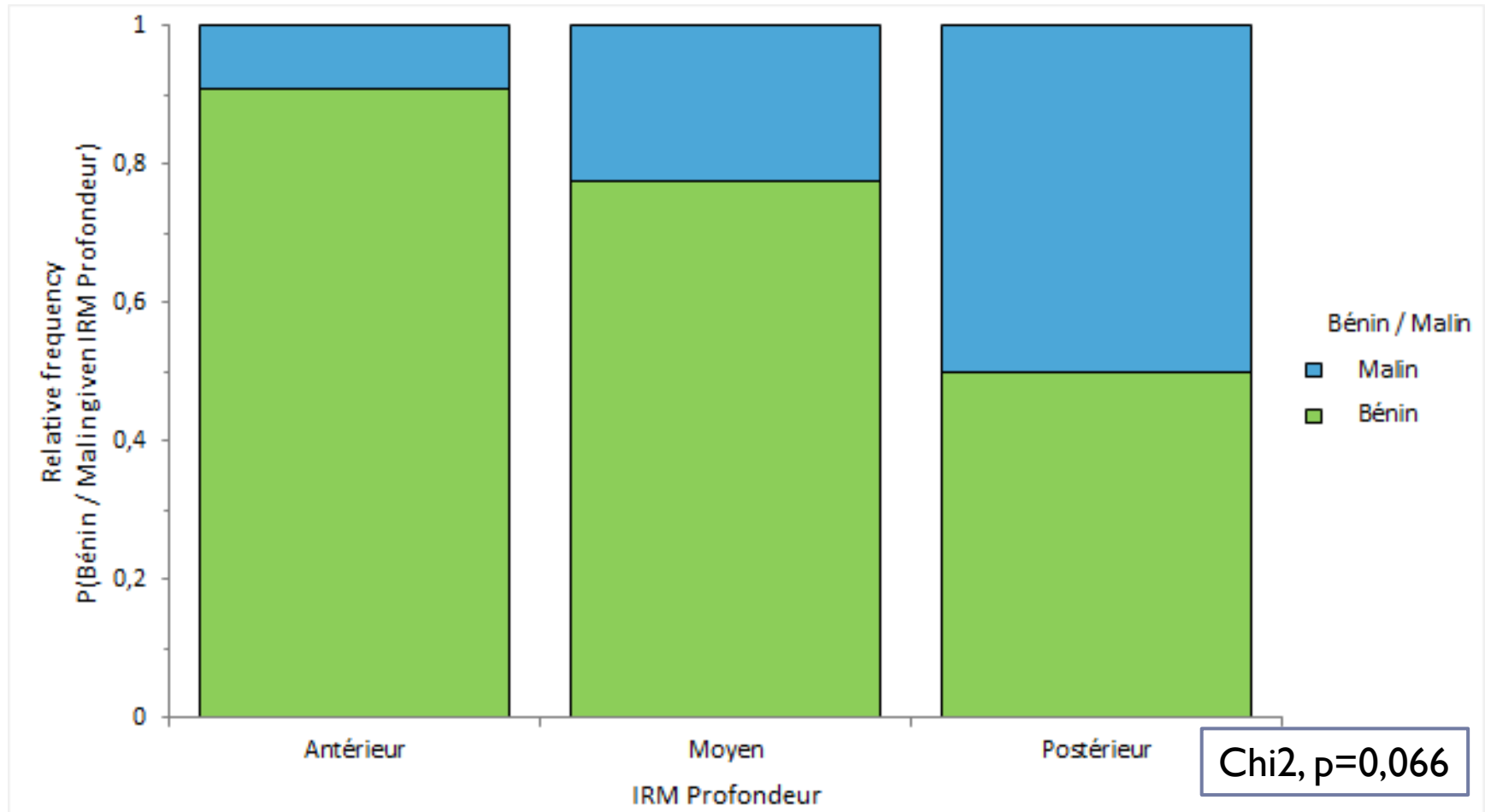
Size	Masses	Non-Masses
<5 mm	50%	?
5-10 mm	56%	13%
10-15 mm	72%	25%
>15 mm	86%	42%



Depth

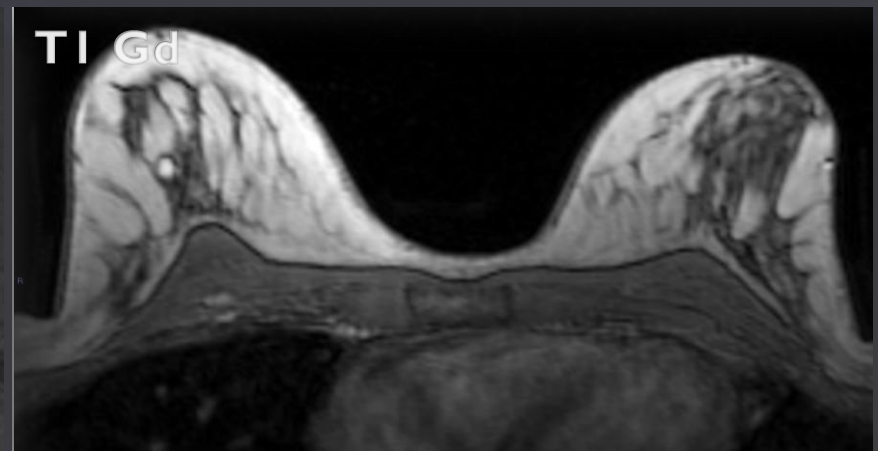
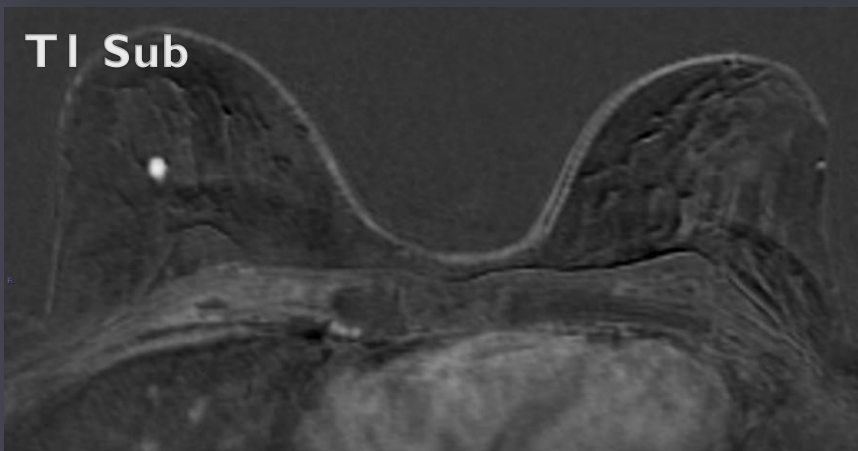
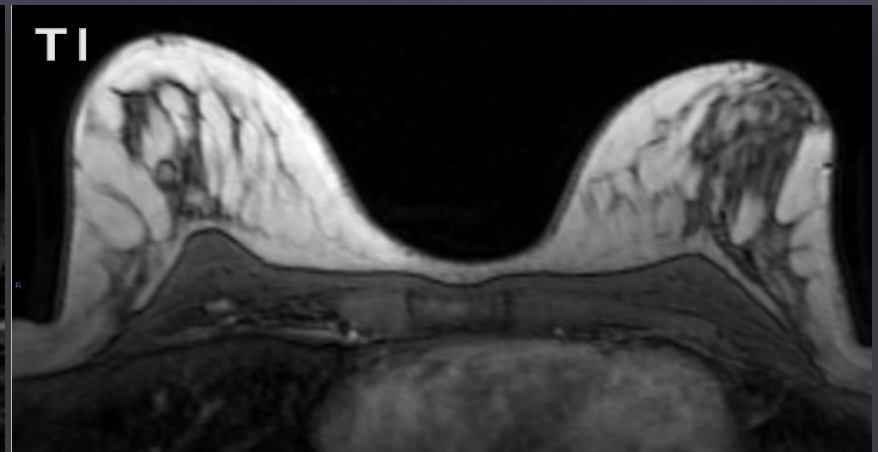
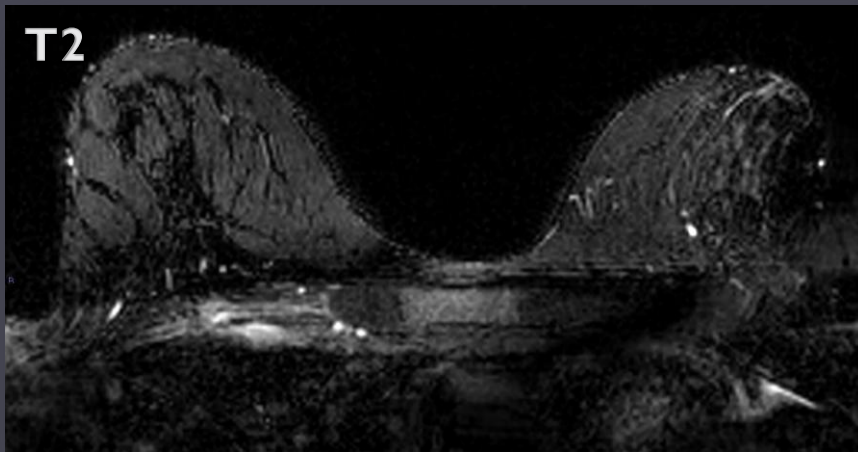
Correlation between MRI & biopsies under second look US

Breast cancer risk according depth



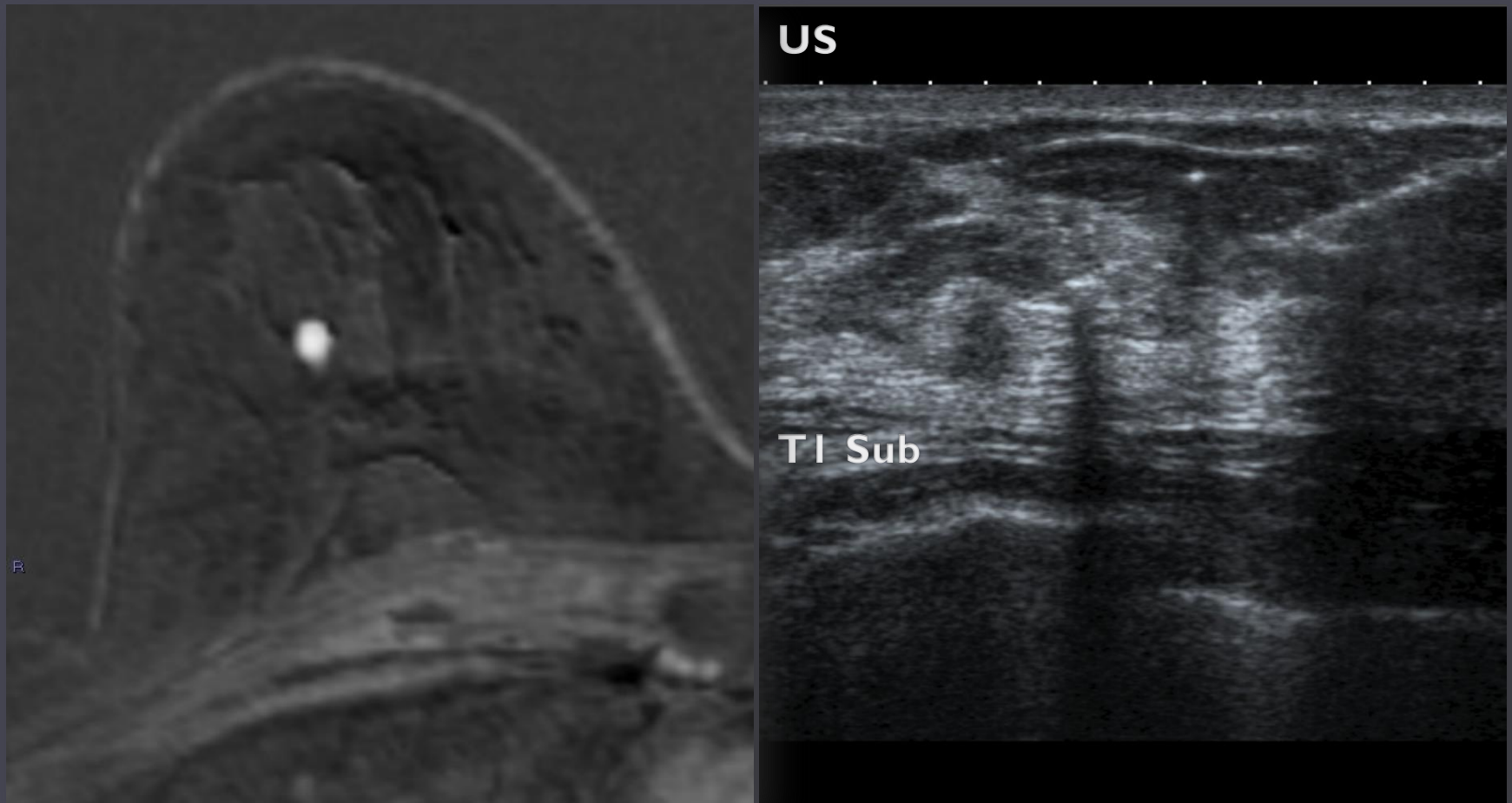
Breast cancer risk according depth

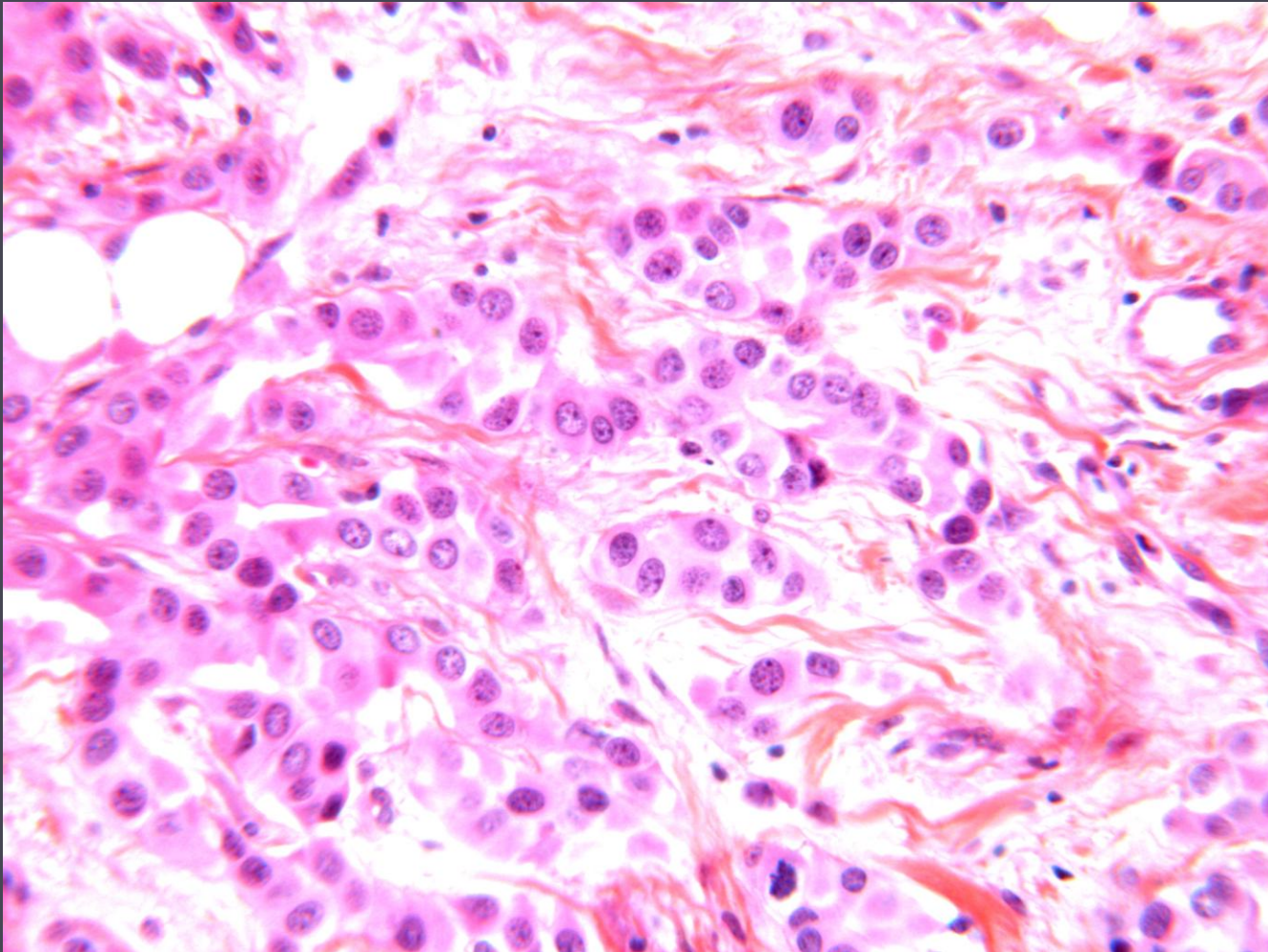
45 yo, left breast cancer staging



Breast cancer risk according depth

45 yo, left breast cancer staging





IDC
SBR grade II

Cancer rates according to risk factor

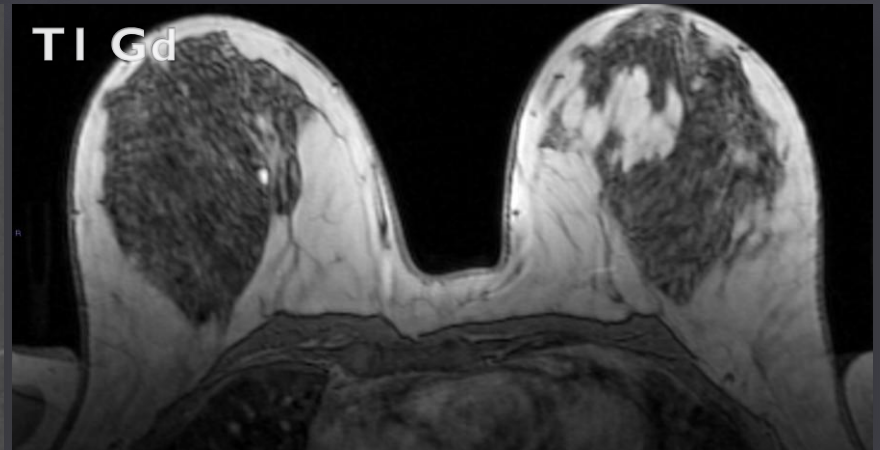
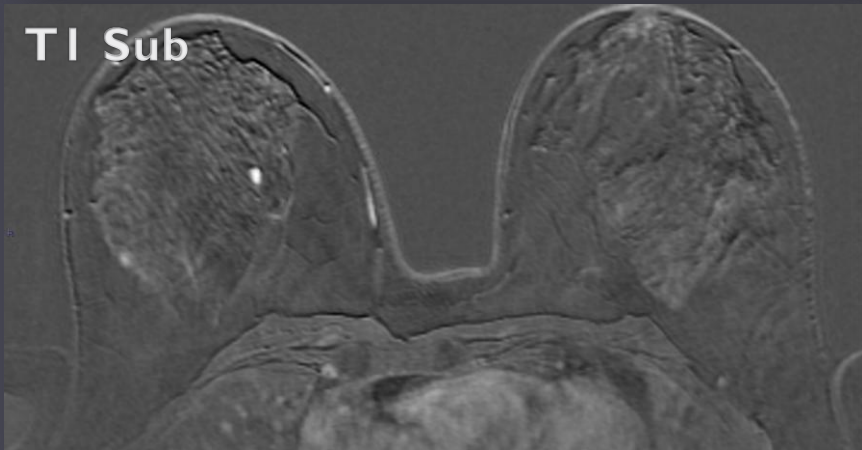
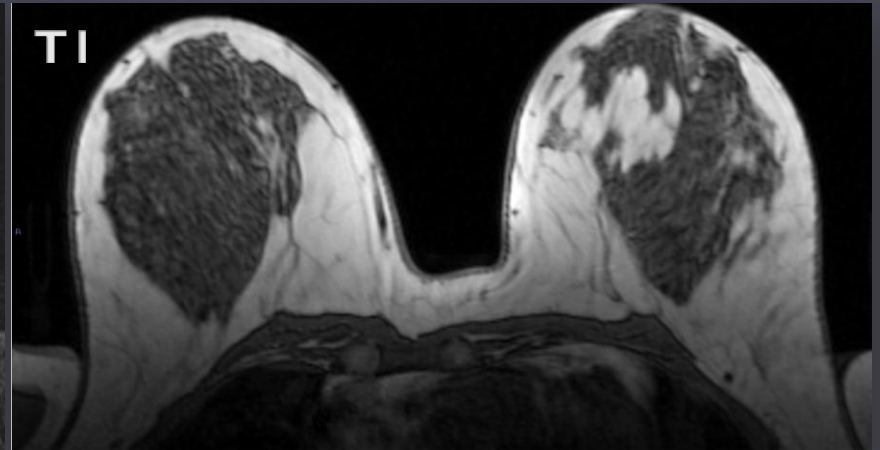
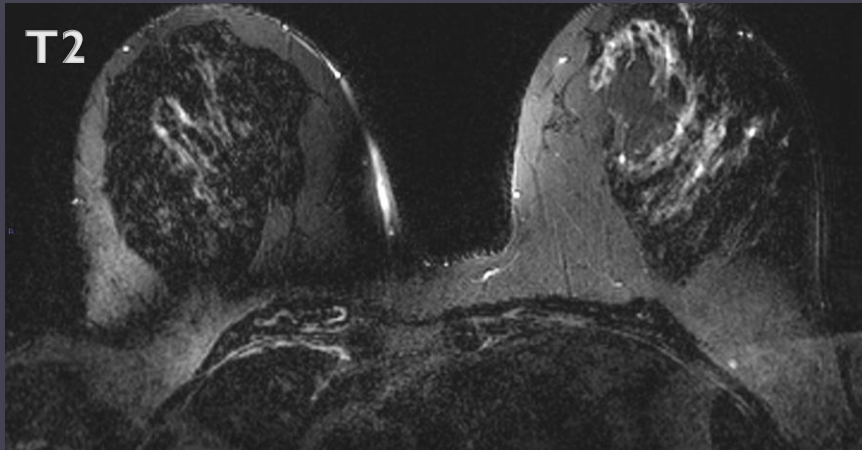
Correlation between MRI & biopsies under second look US

Cancer rate according to risk factors

- ▶ High risk versus no risk patient
 - ▶ Fisher test, $p=0.79$
- ▶ History of breast cancer in young patient
 - ▶ Fisher, $p=0.34$
- ▶ During staging
 - ▶ Fisher, $p=0.80$
- ▶ Be careful with suspicious Clinical findings

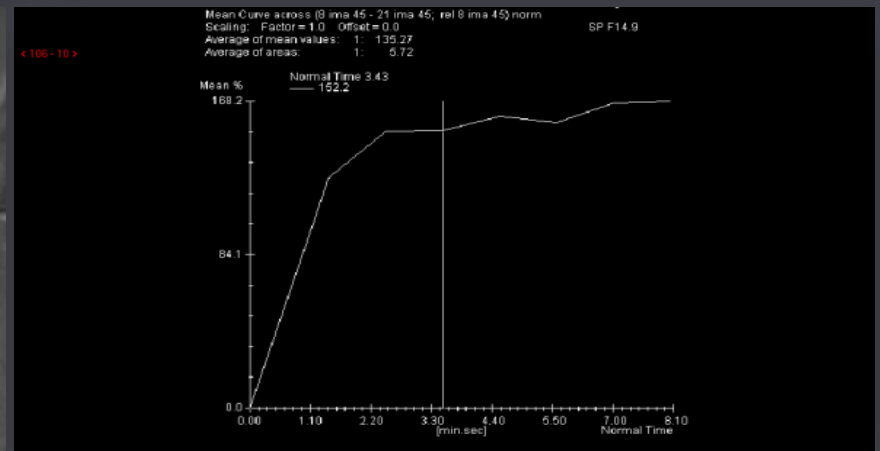
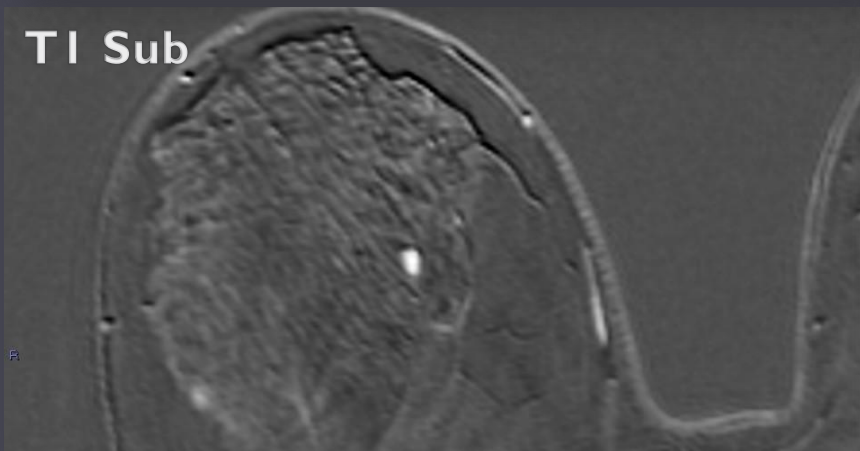
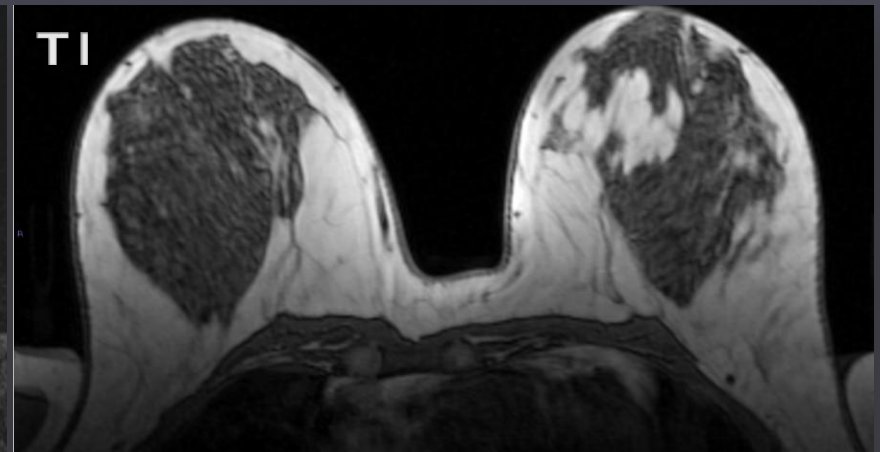
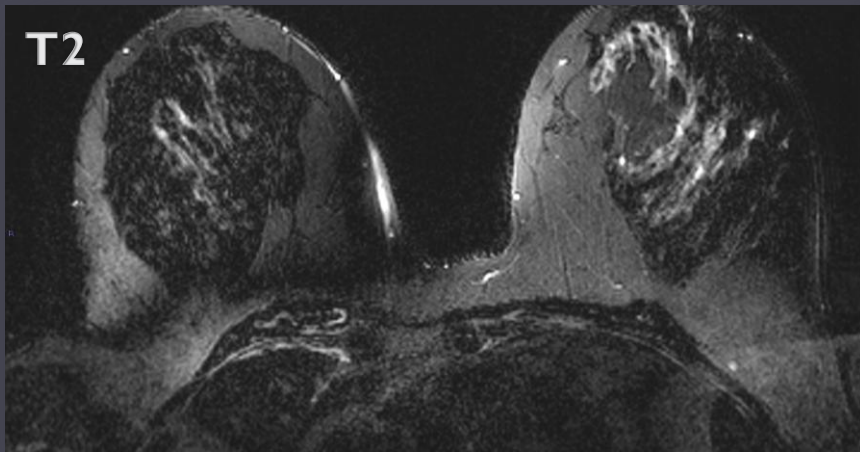
Risk factors

37 yo, BRCA1 mutation, history of right breast cancer, screening



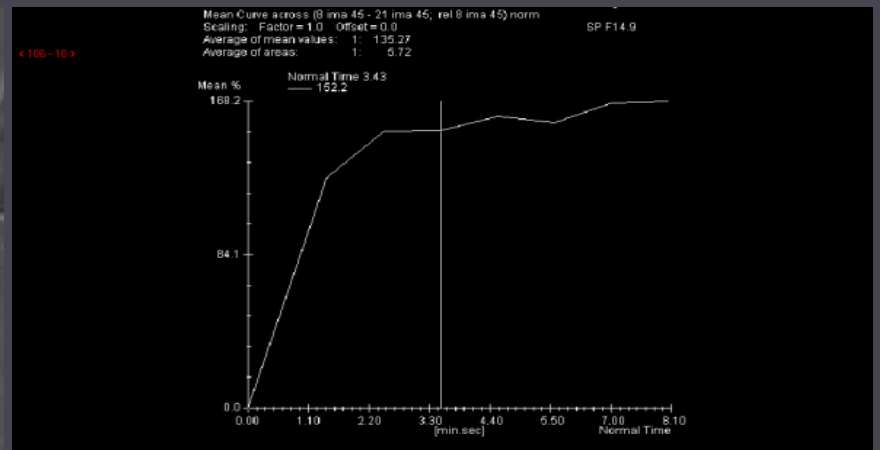
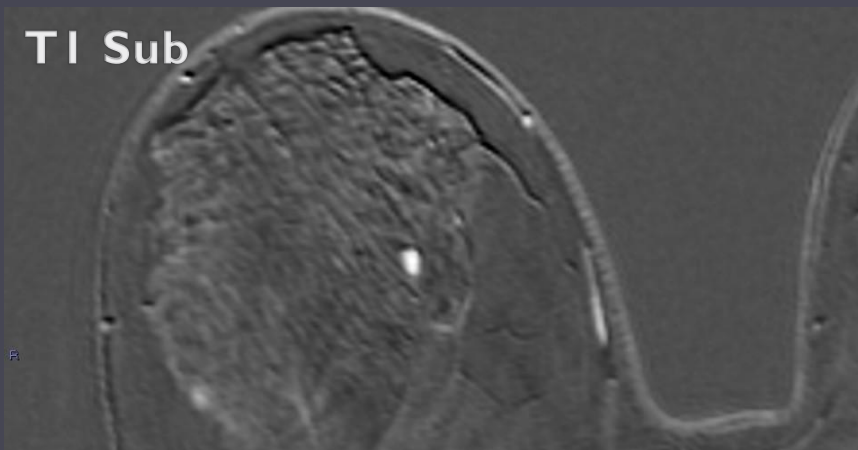
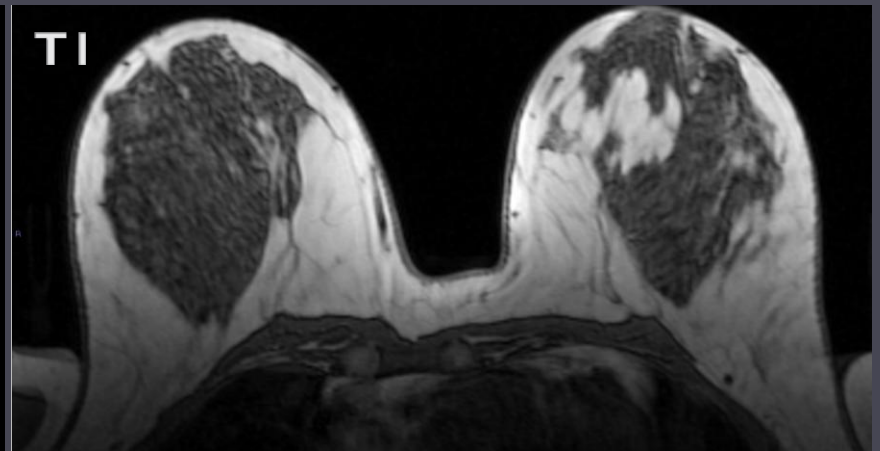
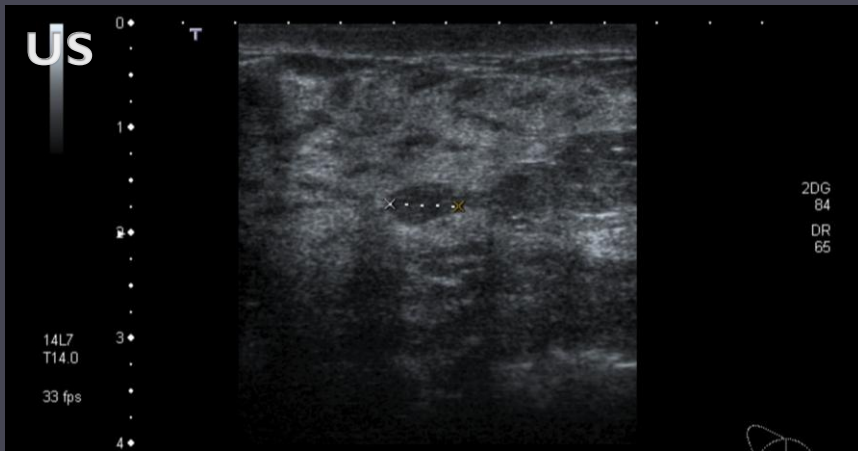
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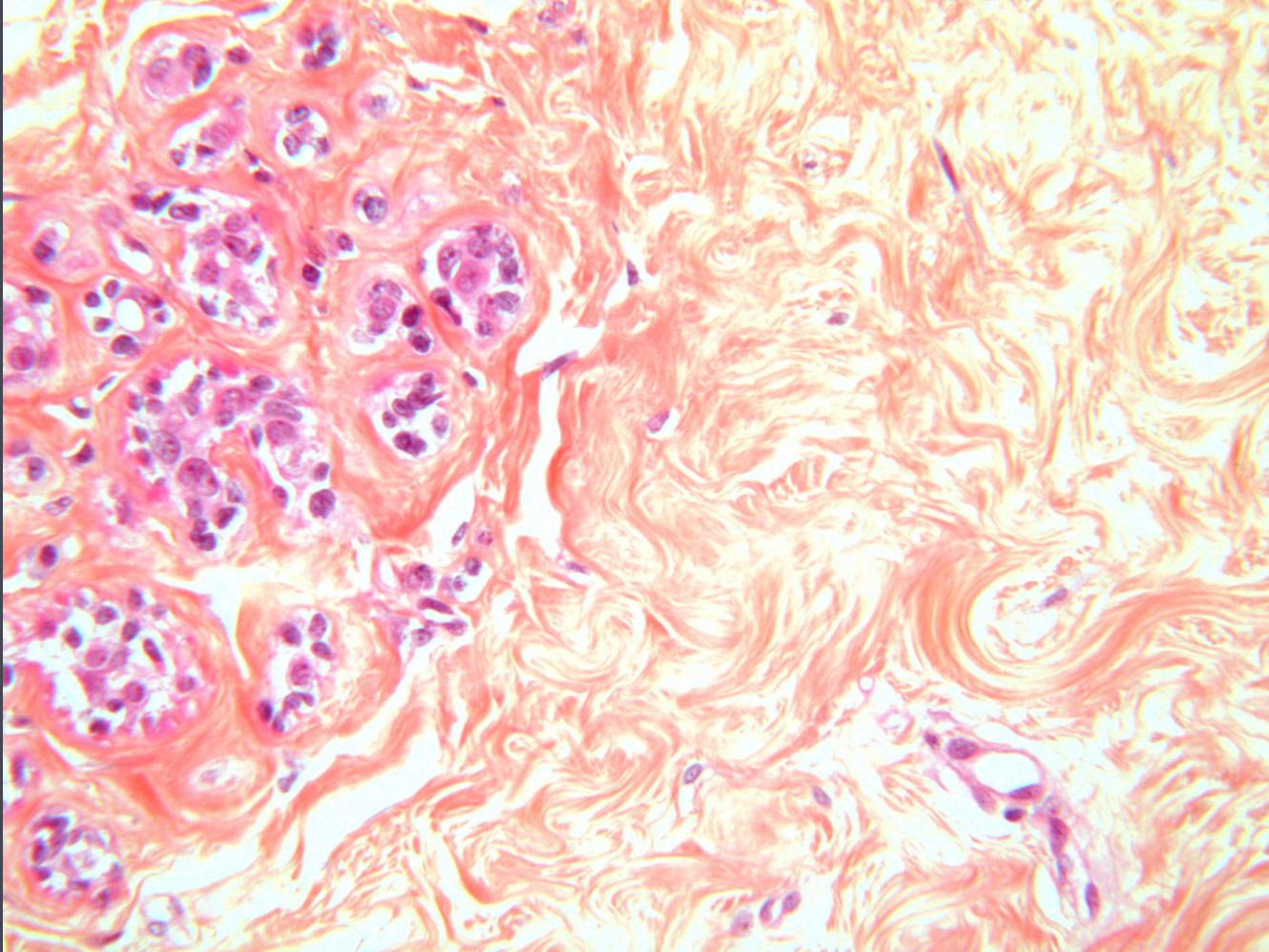
37 yo, BRCA1 mutation, history of right breast cancer, screening



Risk factors

37 yo, BRCA1 mutation, history of right breast cancer, screening





Fibrous dystrophy

Cancer rates according to morphological findings in MRI

Correlation between MRI & biopsies under second look US

Suspicious findings in MRI

▶ Mass

- ▶ Margins: NPV = 0.86 (Fisher test, $p=0.03$)
- ▶ Enhancement curves: NPV = 1 (Fisher test, $p=0.01$)
- ▶ T1, T2, Shape, internal enhancement : (Fisher test, $p>0.072$)
- ▶ Size (Student's t-test, $p = 0.89$).

▶ Non-Mass

- ▶ Distribution, internal enhancement: NPV < 0.85 (Fisher test, $p>0.56$)

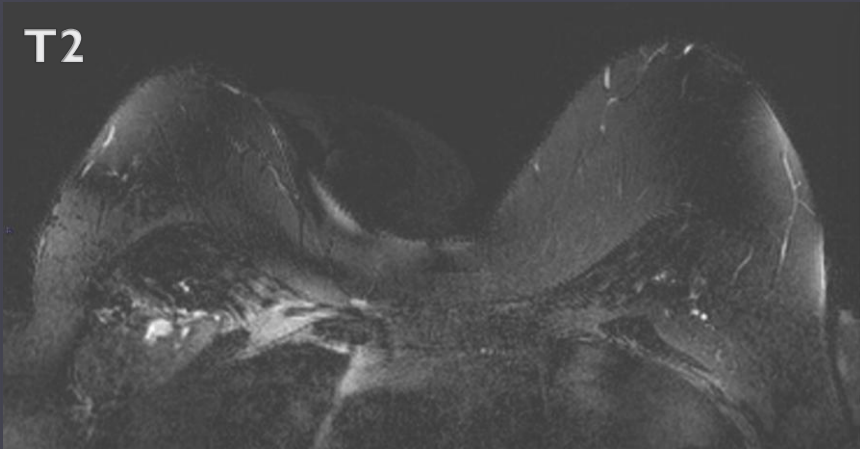
▶ BIRADS

- ▶ BIRADS 3 : NPV = 0.94 (Fisher, $p=0,068$)

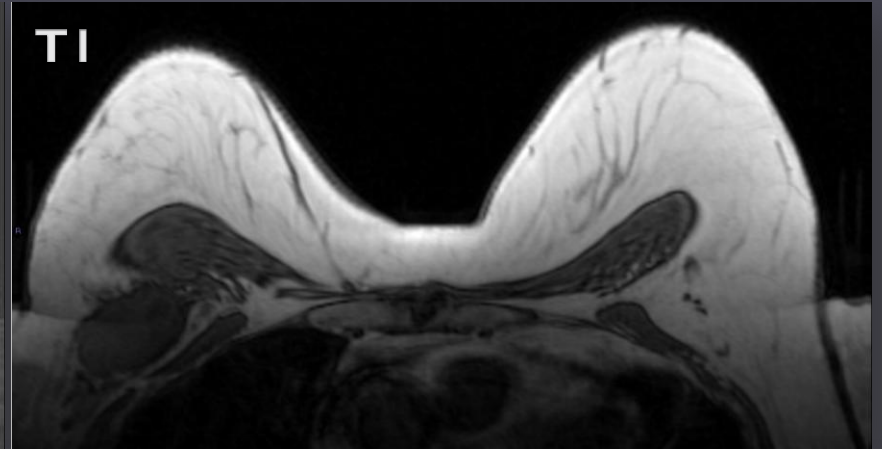
Enhancement curves

69 yo, breast cancer metastasis in axillary lymph nodes

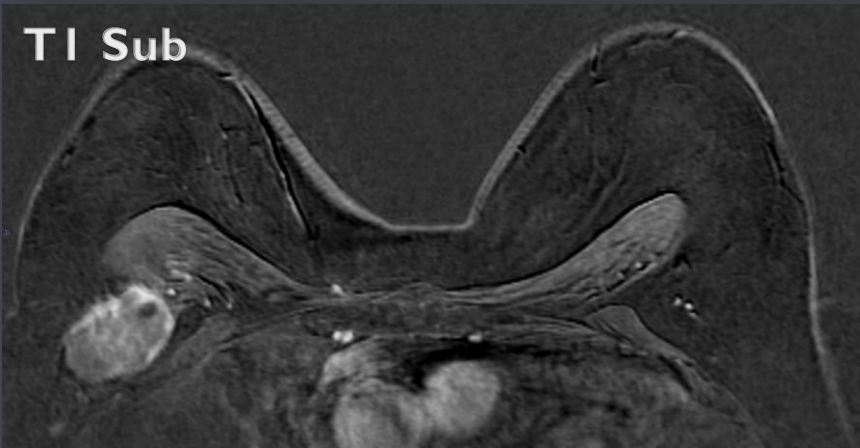
T2



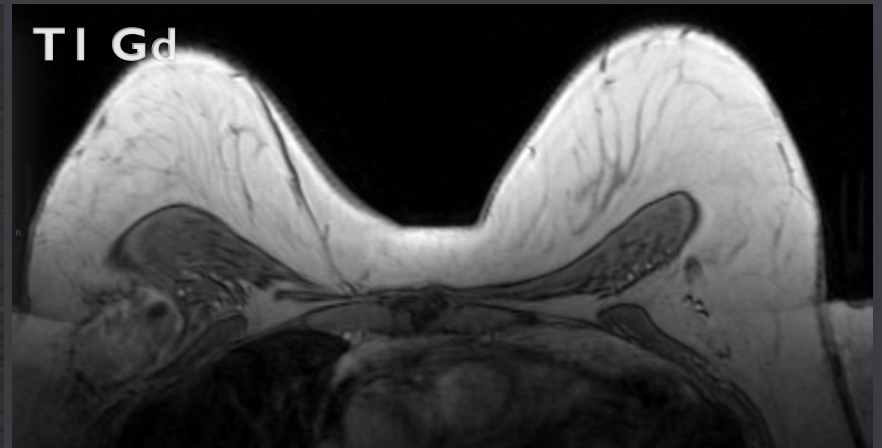
T1



T1 Sub

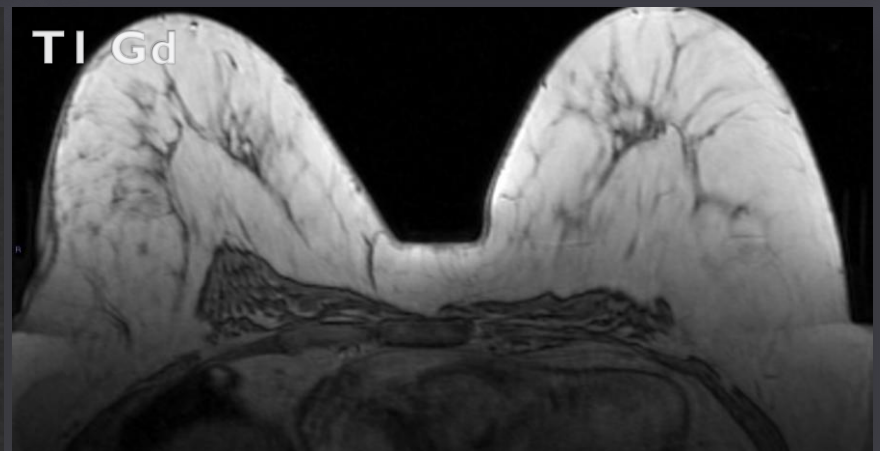
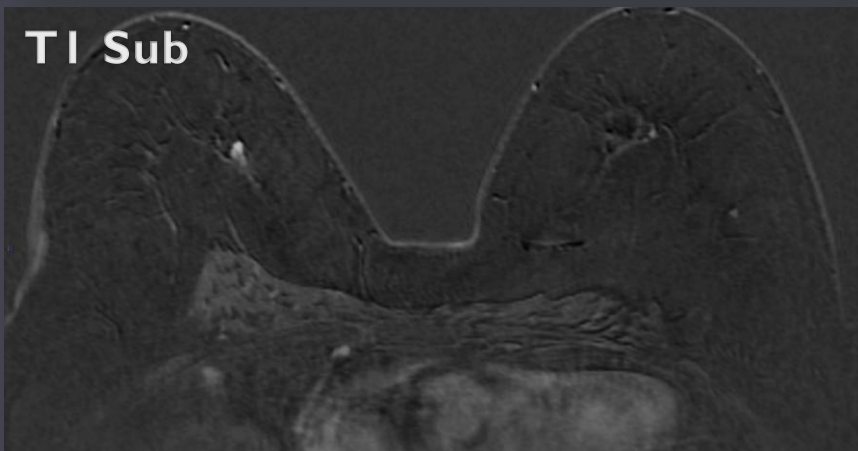
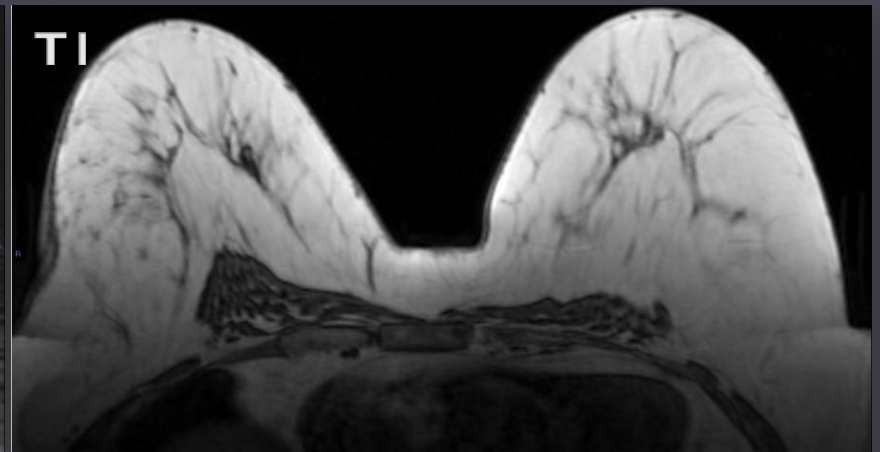
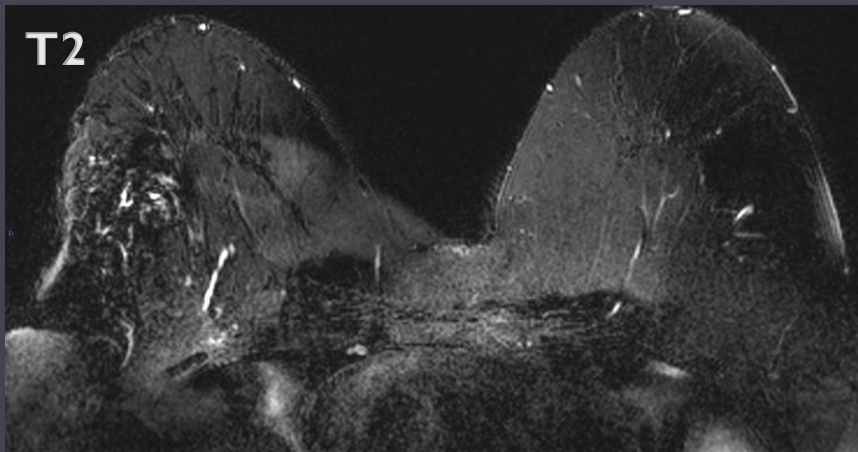


T1 Gd



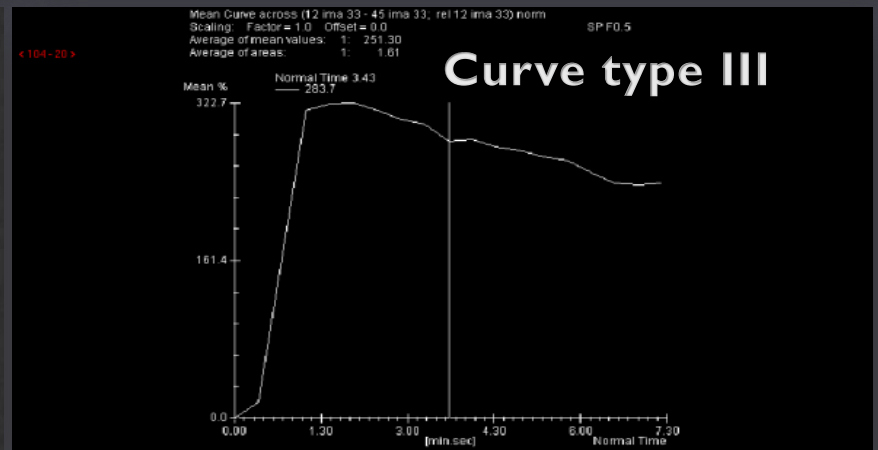
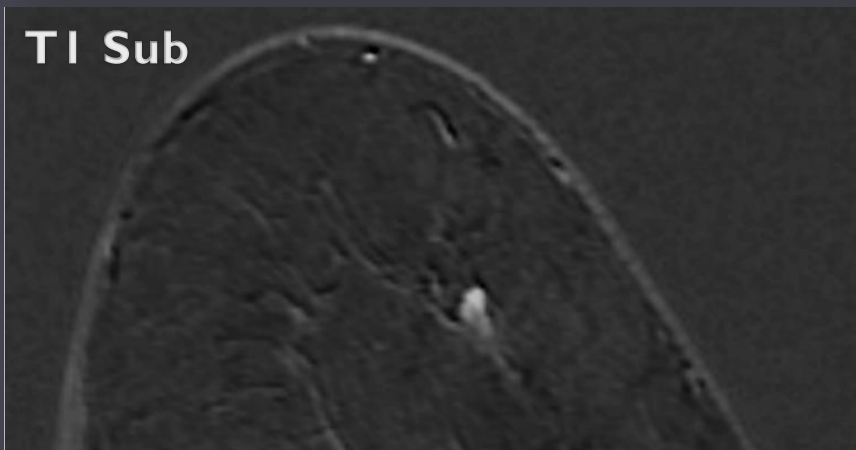
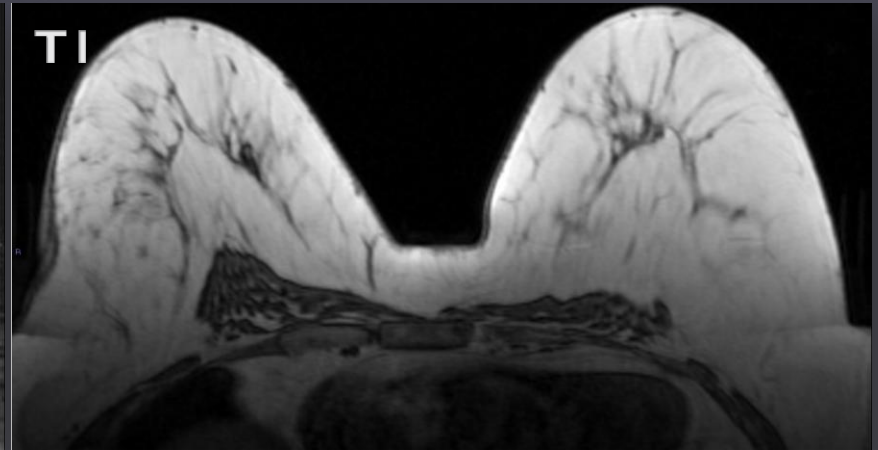
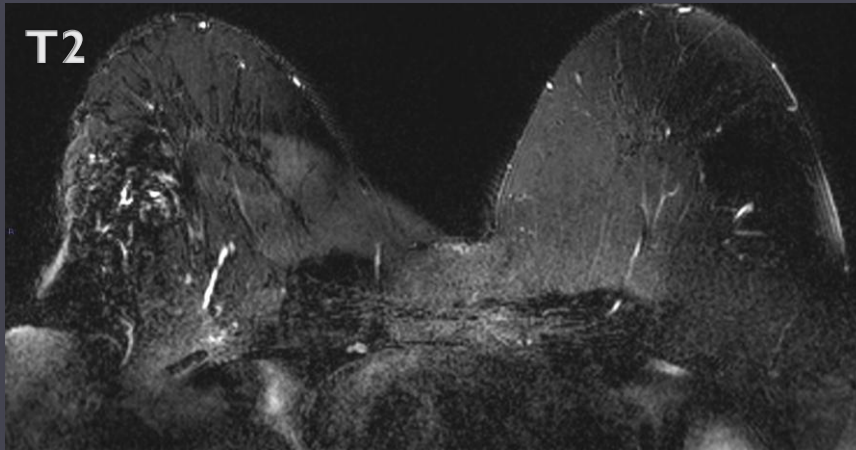
Enhancement curves

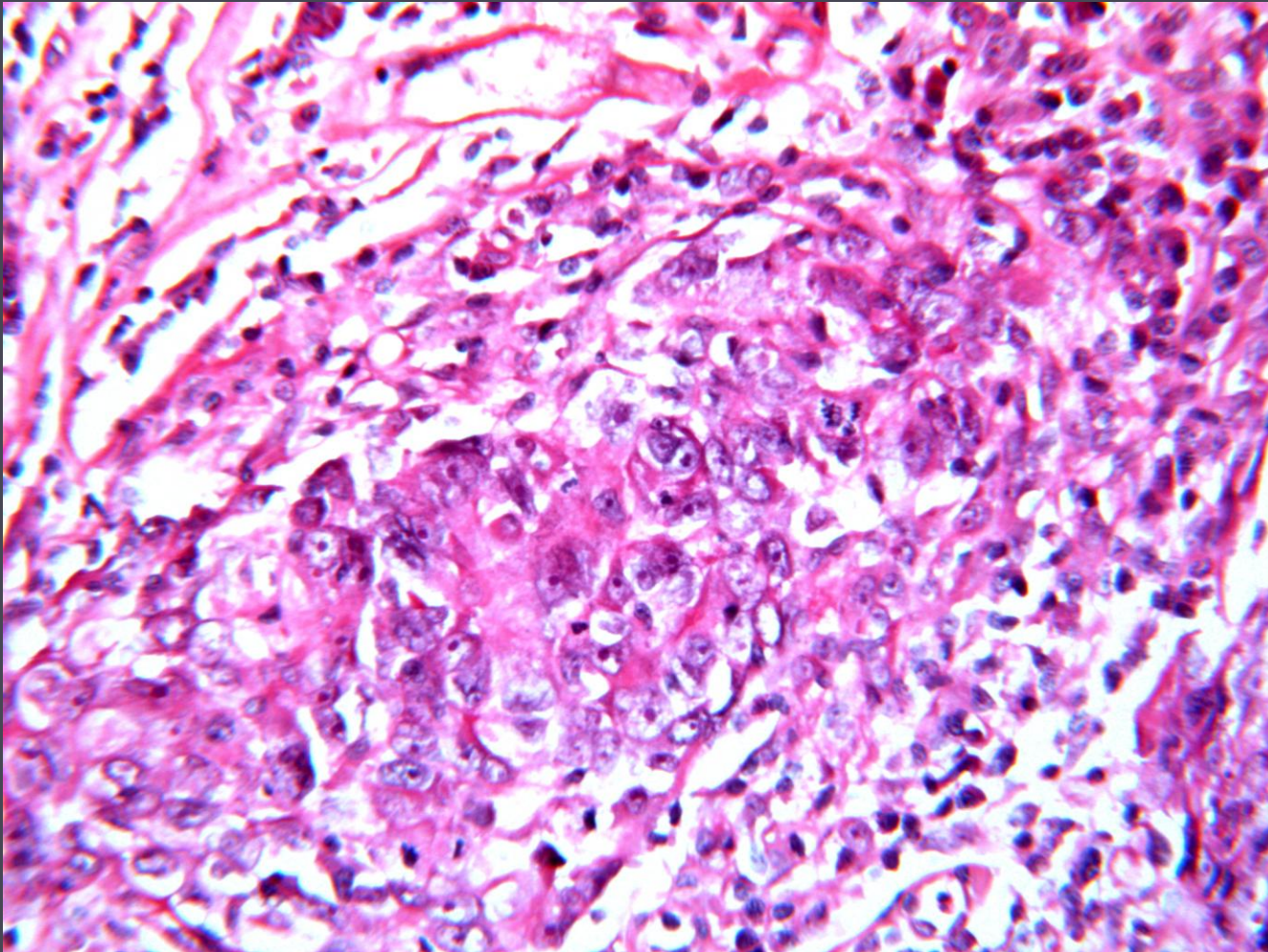
69 yo, breast cancer metastasis in axillary lymph nodes



Enhancement curves

69 yo, breast cancer metastasis in axillary lymph nodes





IDC
SBR grade III
Triple negative

Cancer rates according to morphological findings in US

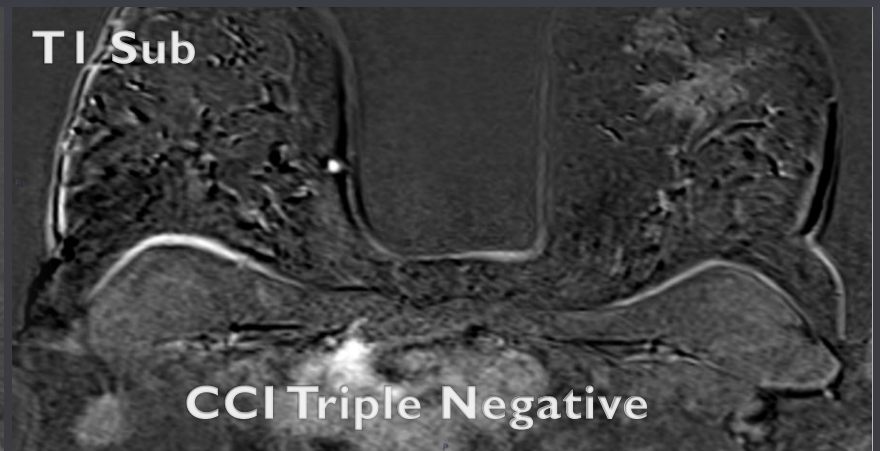
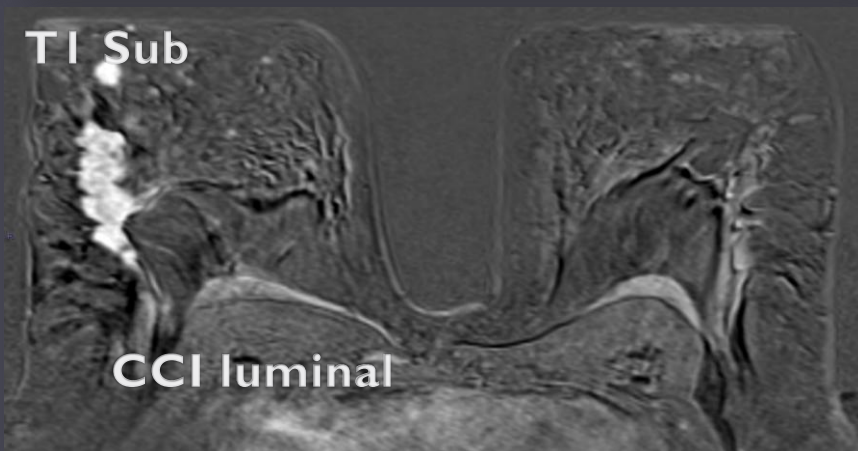
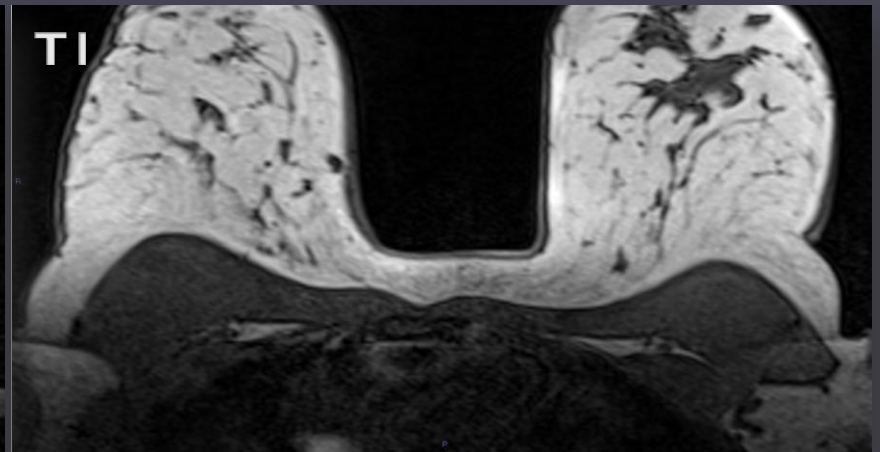
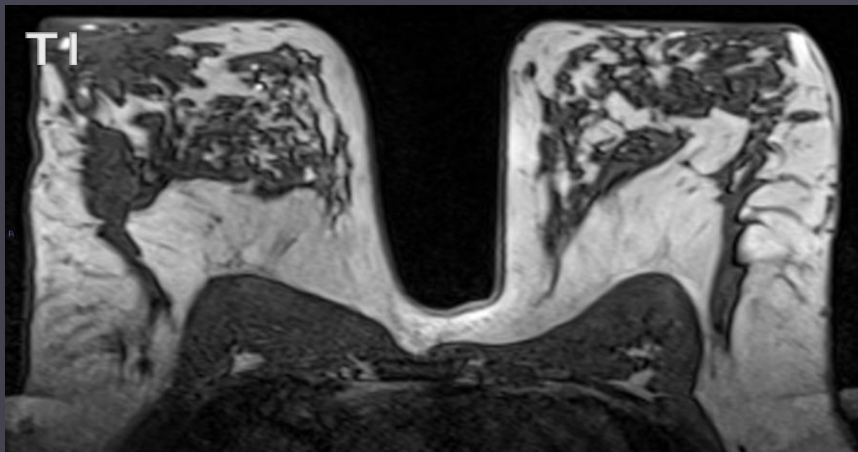
Correlation between MRI & biopsies under second look US

Suspicious findings in US

- ▶ Shape: NPV = 0.90 (Fisher, $p=0.025$)
- ▶ Margin: NPV = 0.91 (Fisher, $p=0,0046$)
- ▶ Orientation: NPV = 0.87 (Fisher, $p=0,0018$)
- ▶ Depth, echogenicity, posterior US Beam (Fisher, $p=0,53$)
- ▶ Taille : t-test, $p=0,65$
- ▶ BIRADS : NPV = 0.95%, (Fisher, $p=0,039$)

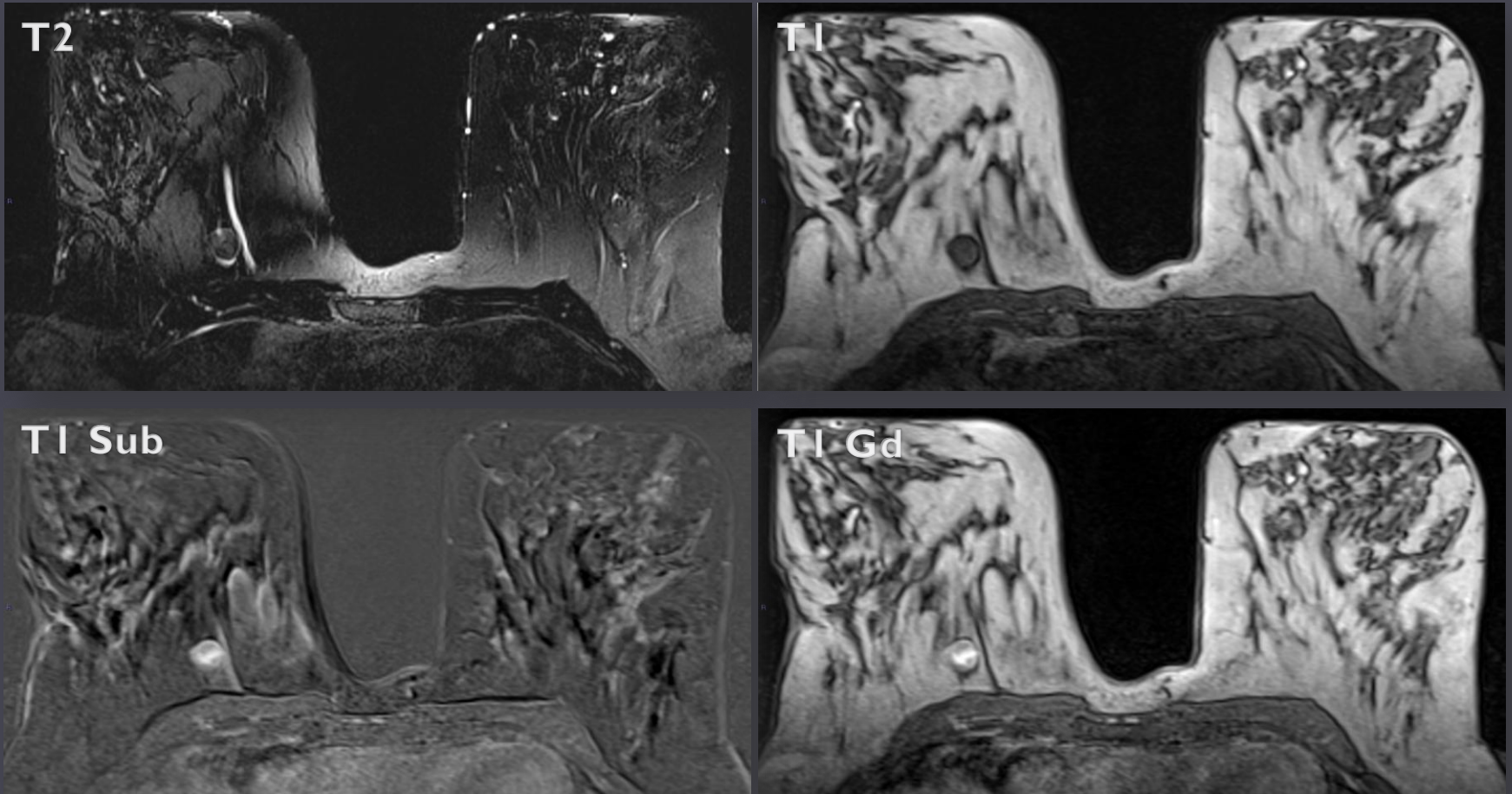
Vertical orientation

44 yo, discrepancy between luminal breast cancer and triple negative lymph node metastasis



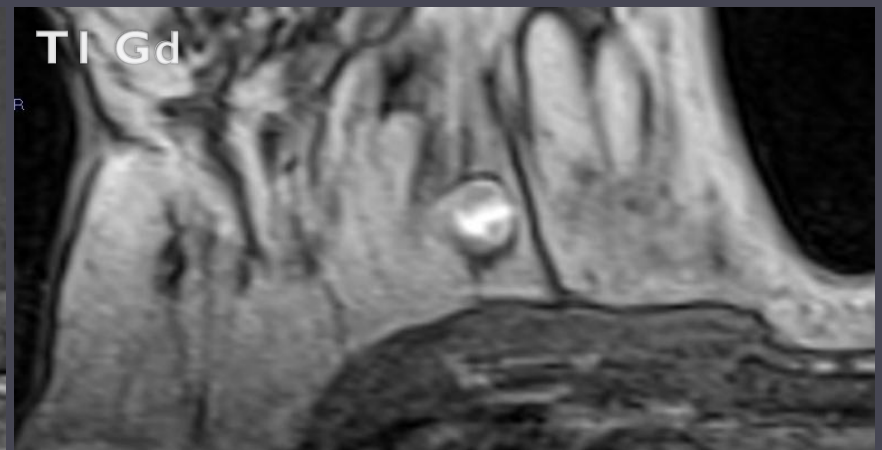
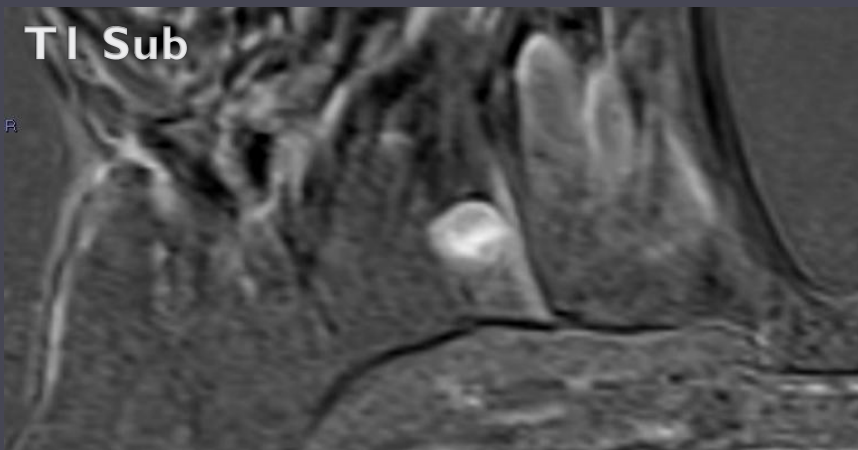
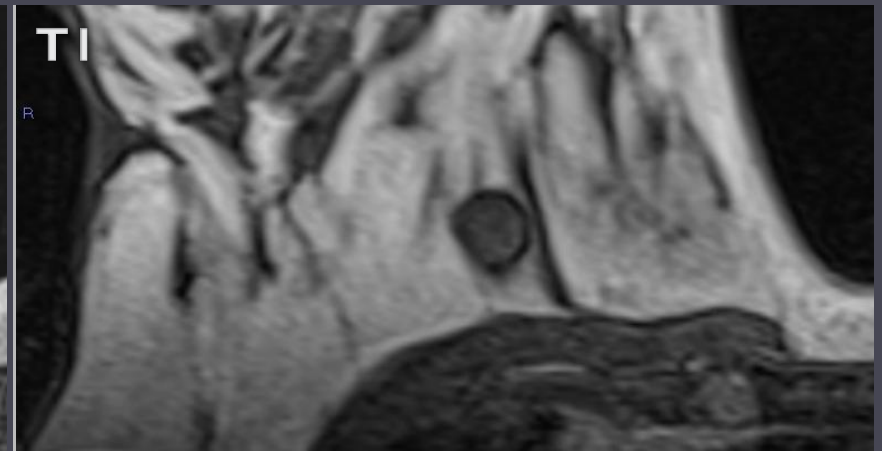
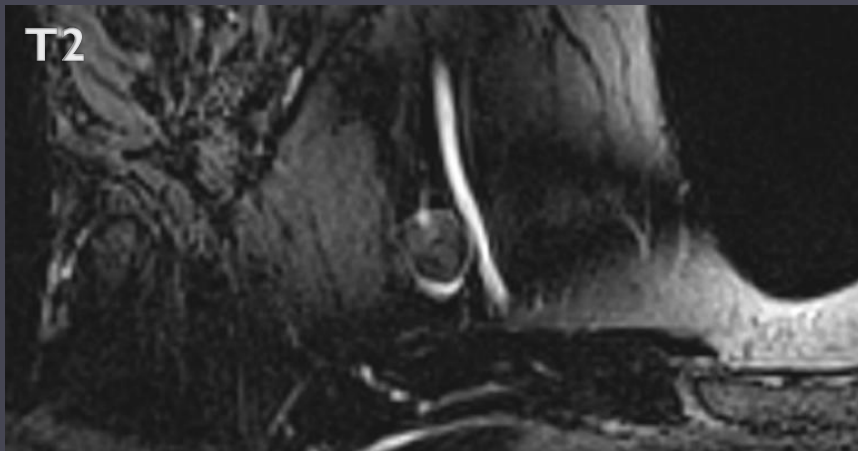
Vertical orientation

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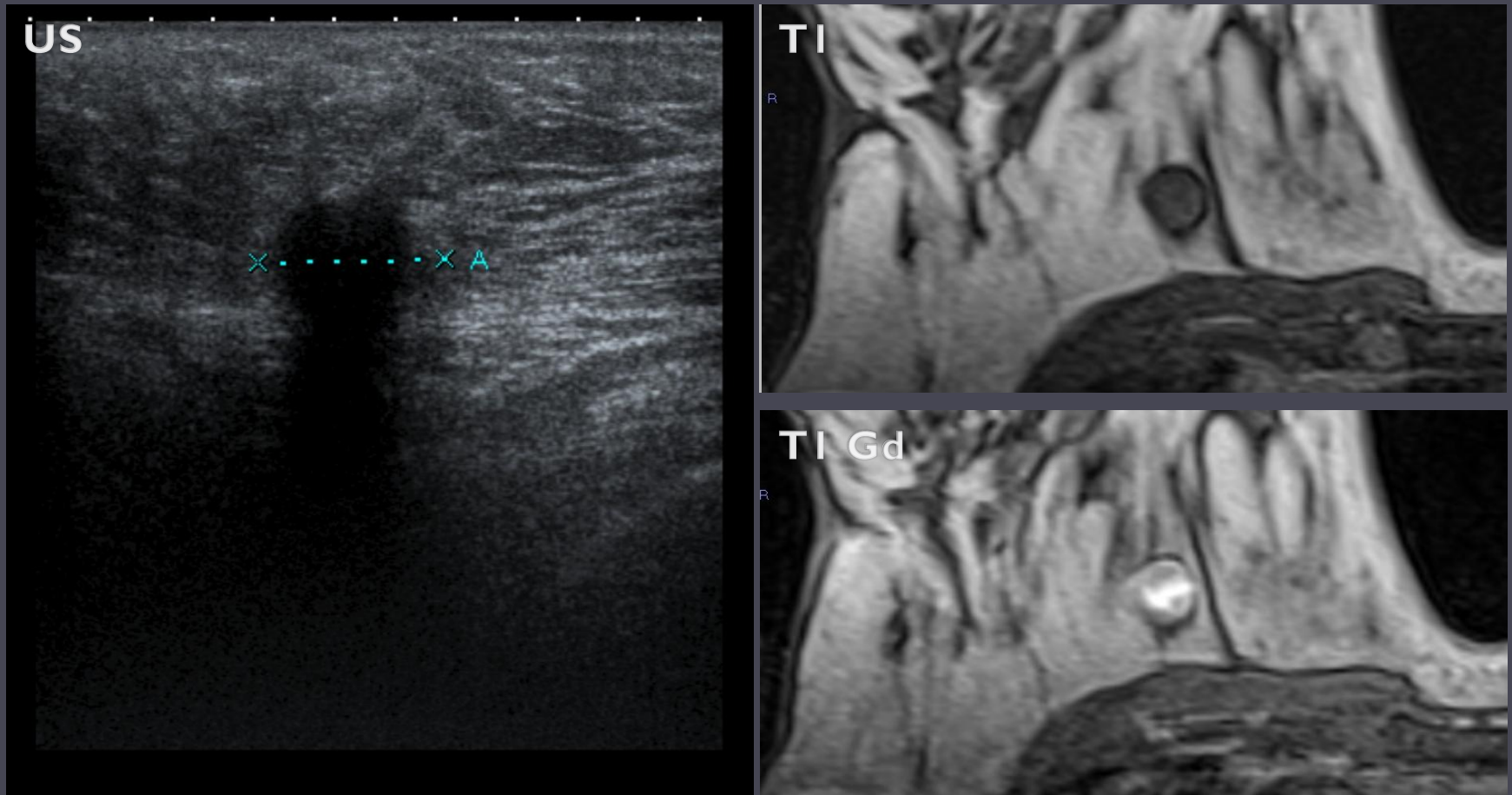
Vertical orientation

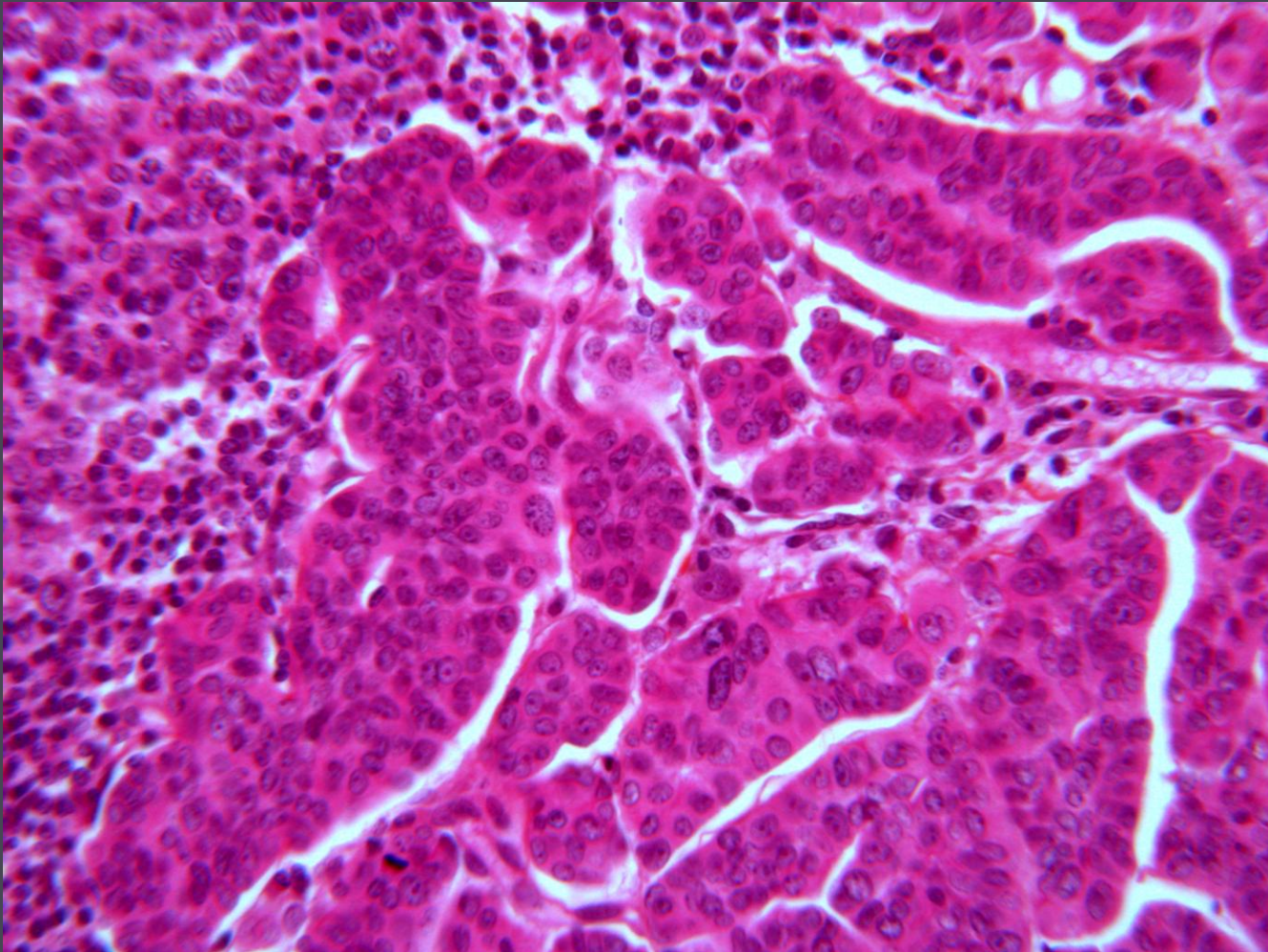
44 yo, discrepancy between luminal breast cancer and triple negative lymph node metastasis



Vertical orientation

44 yo, discrepancy between luminal breast cancer and triple negative lymph node metastasis





IDC
SBR Grade III
Inflammatory stroma

Conclusion

Correlation between MRI & biopsies under second look US

Take Home Messages

- ▶ Risk factors were not reliable criteria for establishing an indication for second look ultrasound
- ▶ Displacement in anterior-posterior axis
- ▶ Masses are found more frequently than non-mass
- ▶ BIRADS 5 are found more frequently than BIRADS 4
- ▶ Circumscribed contours and a progressive enhancement curve for masses on MRI had the strongest NPV (>0.85)
- ▶ Round or oval shape, circumscribed contours and the parallel orientation on US had the strongest NPV (>0.85)
- ▶ Correlation between abnormalities detected on MRI and US is sometimes delicate, biopsy and clip placement should be easily recommended



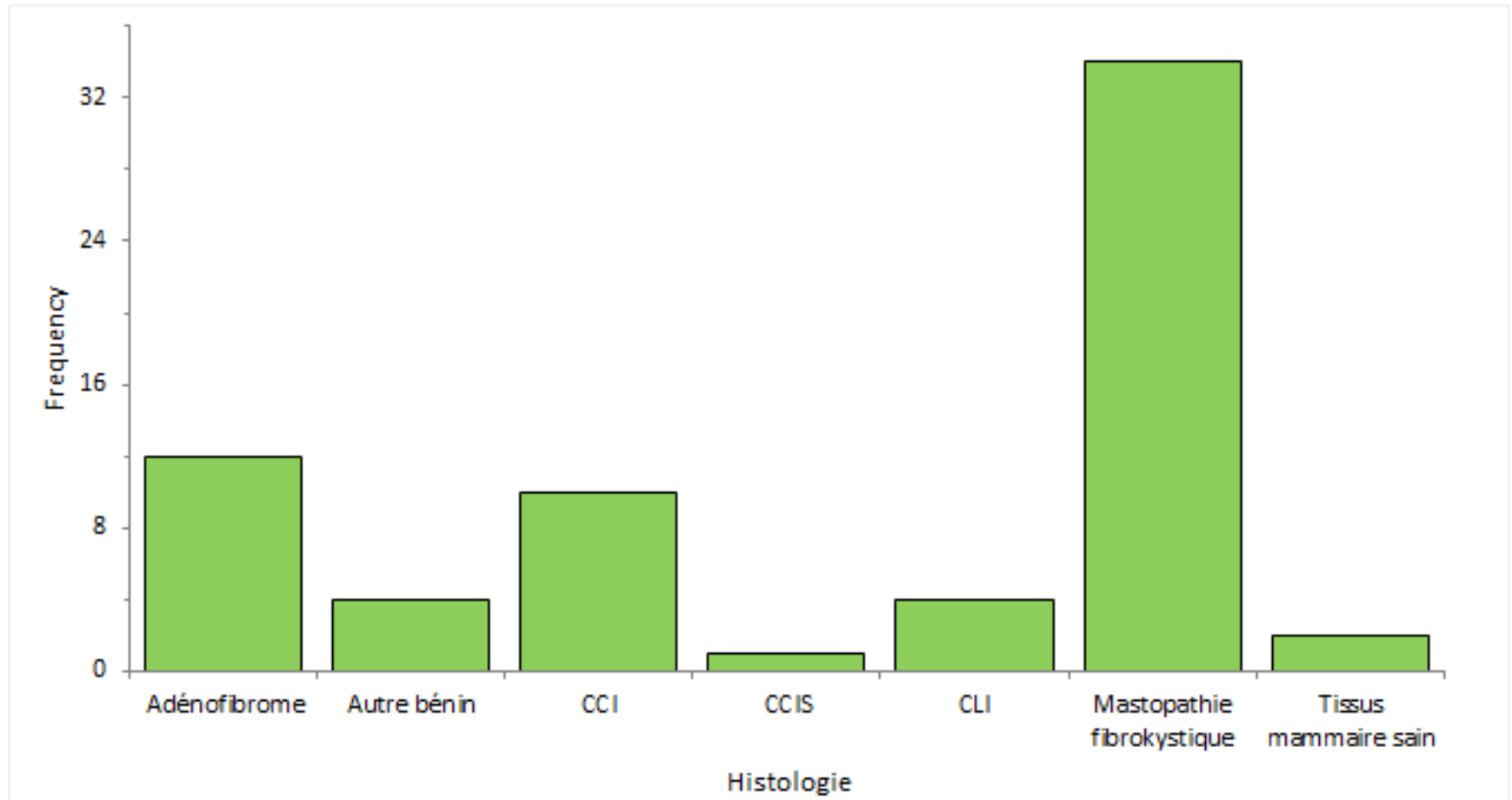
Litterature review

1. Houssami N, Ciatto S, Macaskill P, Lord SJ, Warren RM, Dixon JM, et al. Accuracy and surgical impact of magnetic resonance imaging in breast cancer staging: systematic review and meta-analysis in detection of multifocal and multicentric cancer. *J Clin Oncol Off J Am Soc Clin Oncol*. 2008 Jul 1;26(19):3248–58.
2. Monticciolo DL. Postbiopsy Confirmation of MR-Detected Lesions Biopsied Using Ultrasound. *Am J Roentgenol*. 2012 Jun;198(6):W618–W620.
3. Carbonaro LA, Tannaphai P, Trimboli RM, Verardi N, Fedeli MP, Sardanelli F. Contrast enhanced breast MRI: Spatial displacement from prone to supine patient's position. Preliminary results. *Eur J Radiol*. 2012 Jun;81(6):e771–e774.
4. LaTrenta LR, Menell JH, Morris EA, Abramson AF, Dershaw DD, Liberman L. Breast lesions detected with MR imaging: utility and histopathologic importance of identification with US. *Radiology*. 2003 Jun;227(3):856–61.
5. Berg WA, Blume JD, Cormack JB, Mendelson EB, Madsen EL. Lesion detection and characterization in a breast US phantom: results of the ACRIN 6666 Investigators. *Radiology*. 2006 Jun;239(3):693–702.
6. Trop I, Labelle M, David J, Mayrand MH, Lalonde L. Second-look targeted studies after breast magnetic resonance imaging: practical tips to improve lesion identification. *Current problems in diagnostic radiology*. 2010 Sep;39:200–11.
7. Wiratkapun C, Duke D, Nordmann AS, Lertsithichai P, Narra V, Barton PT, et al. Indeterminate or suspicious breast lesions detected initially with MR imaging: value of MRI-directed breast ultrasound. *Acad Radiol*. 2008 May;15(5):618–25.
8. Meissnitzer M, Dershaw DD, Lee CH, Morris EA. Targeted Ultrasound of the Breast in Women With Abnormal MRI Findings for Whom Biopsy Has Been Recommended. *Am J Roentgenol*. 2009 Oct;193(4):1025–9.
9. Abe H, Schmidt RA, Shah RN, Shimauchi A, Kulkarni K, Sennett CA, et al. MR-Directed (“Second-Look”) Ultrasound Examination for Breast Lesions Detected Initially on MRI: MR and Sonographic Findings. *Am J Roentgenol*. 2010 Feb;194(2):370–7.
10. Sim LSJ, Hendriks JHCL, Bult P, Fook-Chong SMC. US correlation for MRI-detected breast lesions in women with familial risk of breast cancer. *Clin Radiol*. 2005 Jul;60(7):801–6.
11. Fiaschetti V, Salimbeni C, Gaspari E, Dembele GK, Bolacchi F, Cossu E, et al. The role of second-look ultrasound of BIRADS-3 mammary lesions detected by breast MR imaging. *Eur J Radiol*. 2012 Nov;81(11):3178–84.
12. Trop I, David J, Lalonde L. Postbiopsy confirmation of adequate targeting after second-look biopsy of MRI-enhancing breast lesions. *Ajr Am J Roentgenol*. 2013 Jan;200(1):W93.
13. Elshof LE, Rutgers EJT, Deurloo EE, Loo CE, Wesseling J, Pengel KE, et al. A practical approach to manage additional lesions at preoperative breast MRI in patients eligible for breast conserving therapy: results. *Breast Cancer Res Treat*. 2010 Jul 22;124(3):707–15.
14. Holland R, Hendriks JH, Vebeek AL, Mravunac M, Schuurmans Stekhoven JH. Extent, distribution, and mammographic/histological correlations of breast ductal carcinoma in situ. *Lancet*. 1990 Mar 3;335:519–22.
15. Sardanelli F, Boetes C, Borisch B, Decker T, Federico M, Gilbert FJ, et al. Magnetic resonance imaging of the breast: recommendations from the EUSOMA working group. *Eur J Cancer*. 2010 May;46:1296–316.
16. Nakano S, Kousaka J, Fujii K, Yorozuya K, Yoshida M, Mouri Y, et al. Impact of real-time virtual sonography, a coordinated sonography and MRI system that uses an image fusion technique, on the sonographic evaluation of MRI-detected lesions of the breast in second-look sonography. *Breast Cancer Res Treat*. 2012 Jul 24;134(3):1179–88.

Pathology

Correlation between MRI & biopsies under second look US

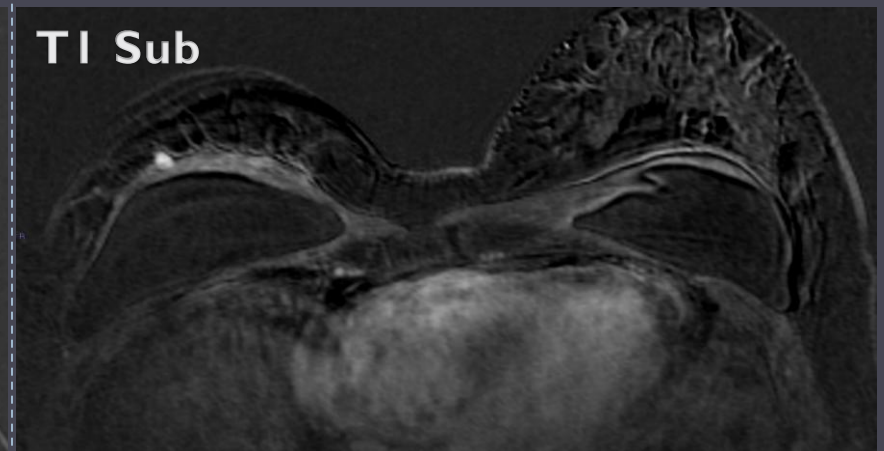
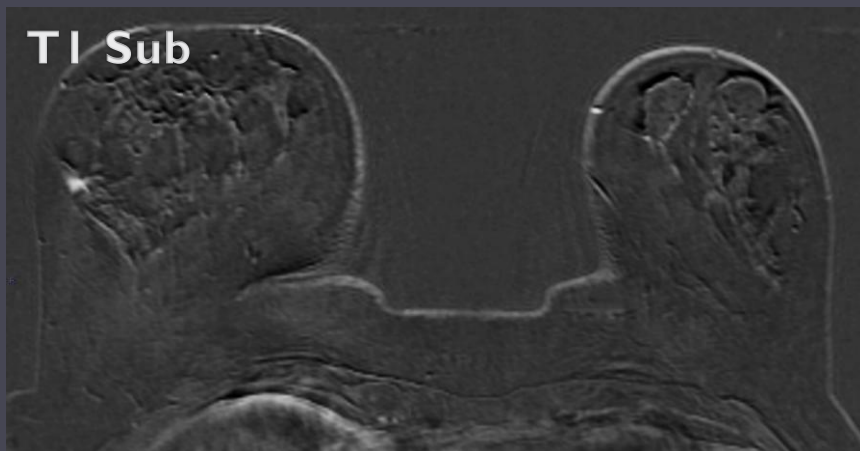
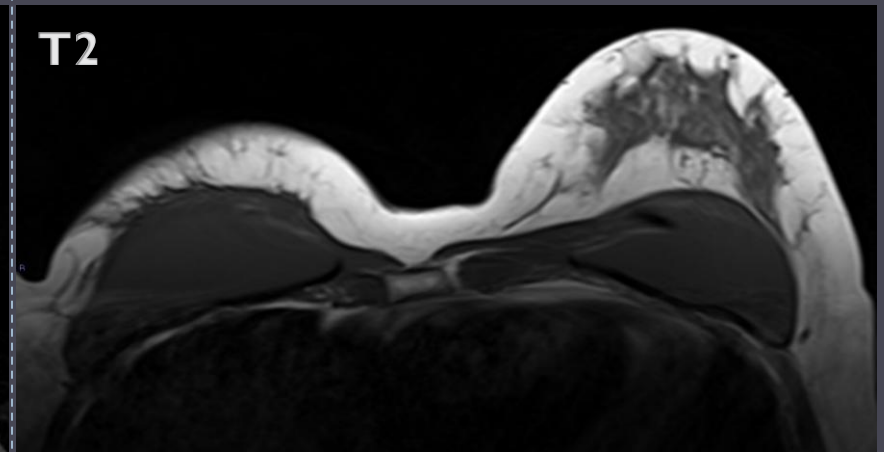
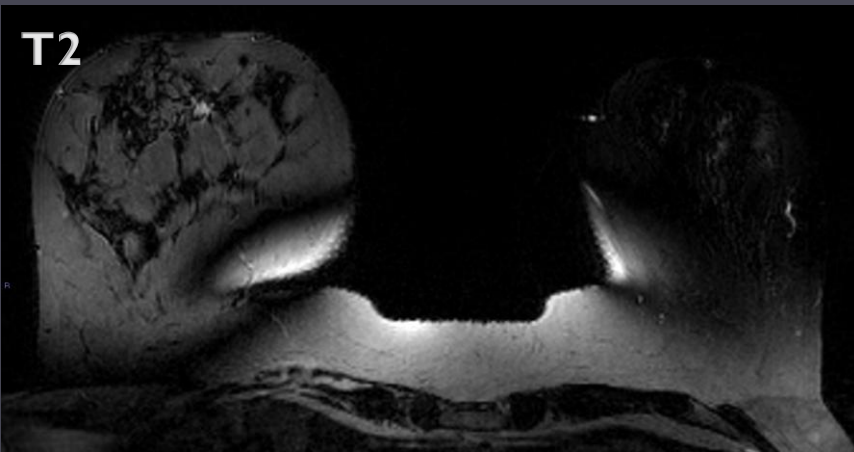
Pathology



Fibrosis changes

59 yo, history of right breast cancer, right nipple retraction

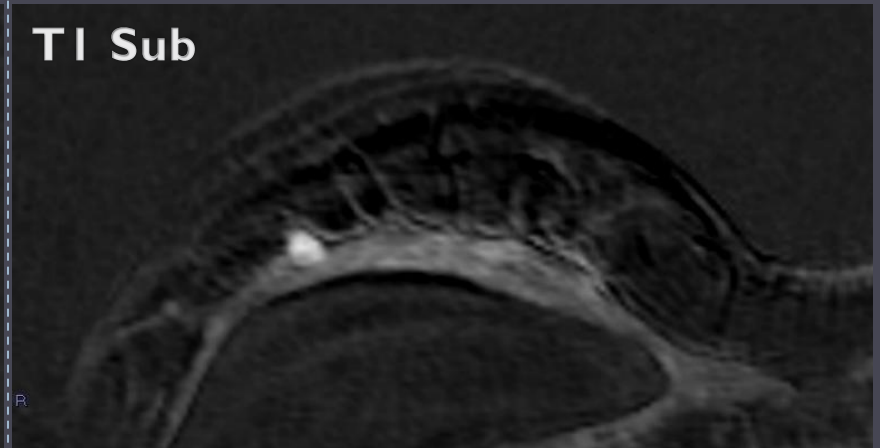
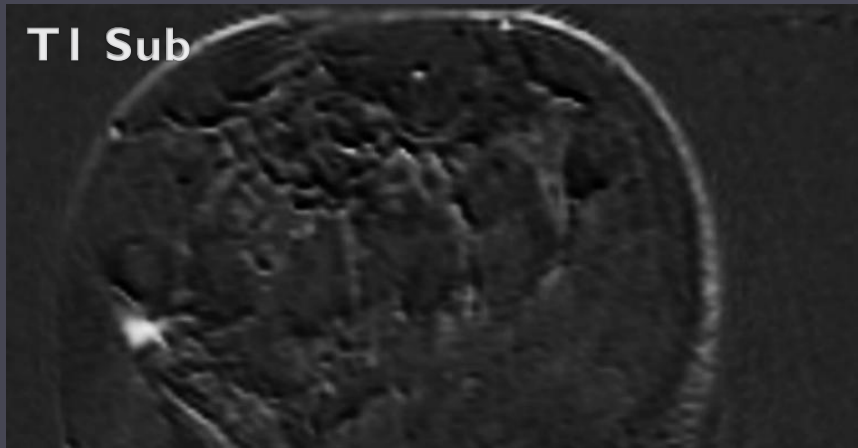
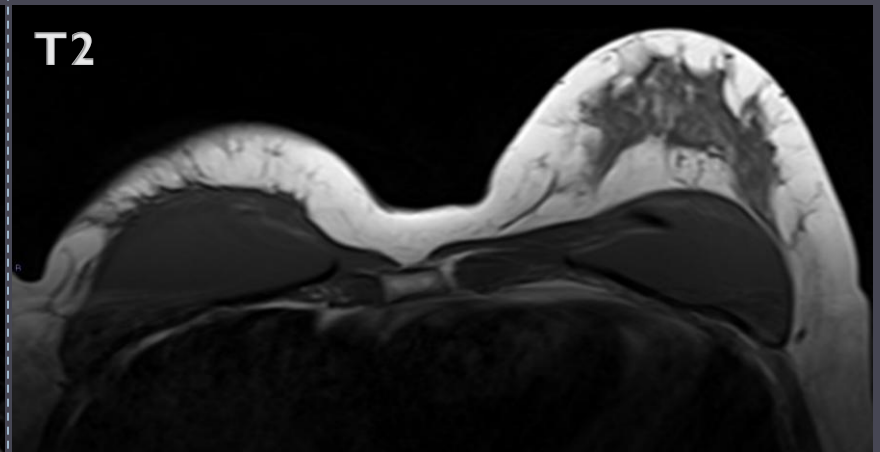
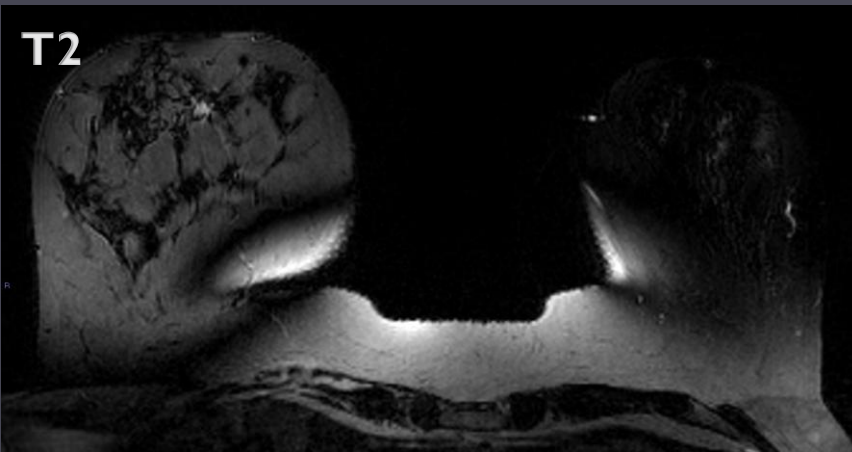
46 yo, BRCA 2, history of breast cancer, follow up



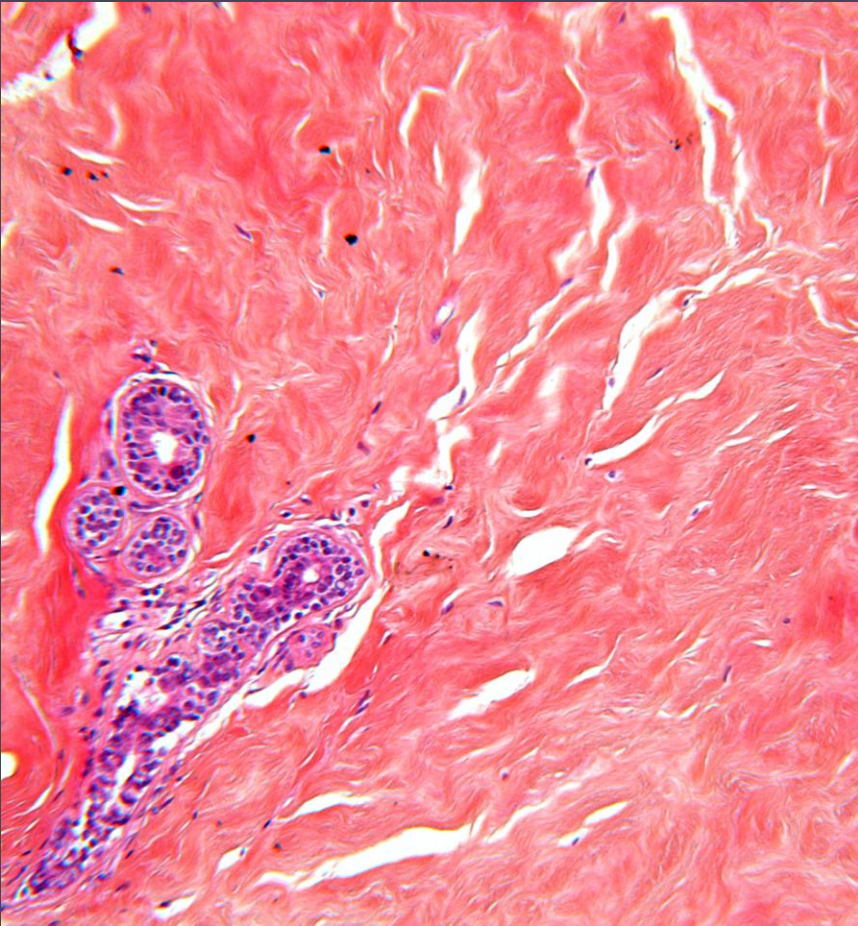
Fibrosis changes

59 yo, history of right breast cancer, right nipple retraction

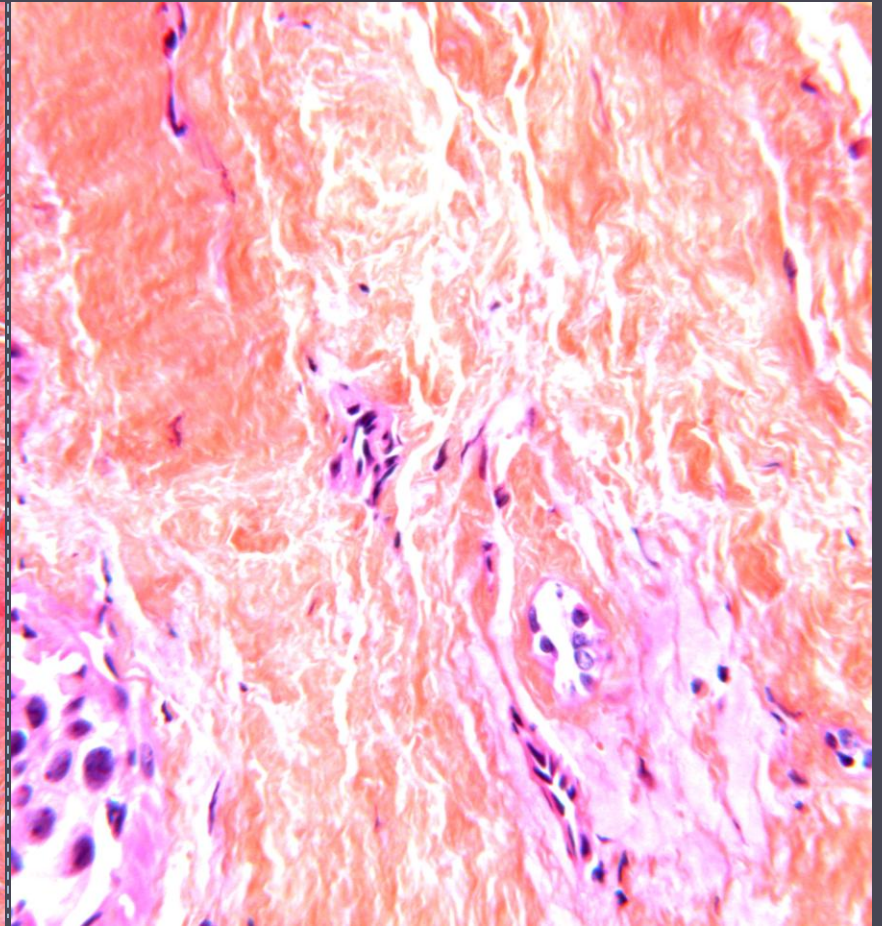
46 yo, BRCA 2, history of breast cancer, follow up



Fibrous Dystrophy



Fibrosis, nuclear dystrophy post radiotherapy

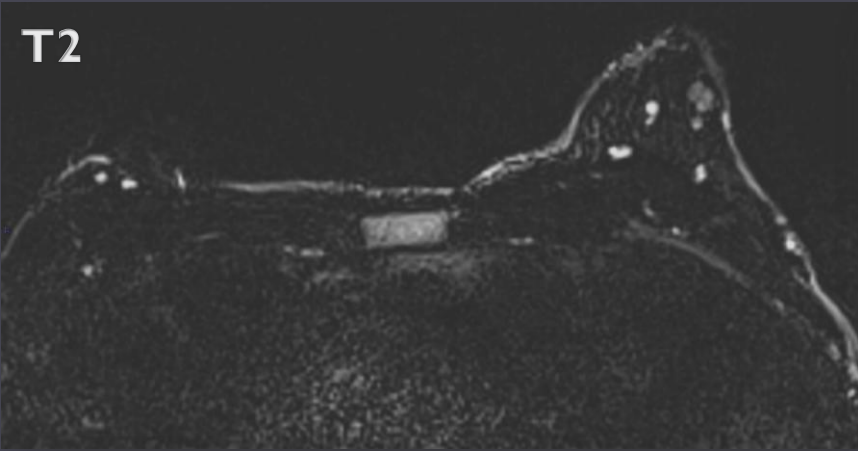


MRI Findings

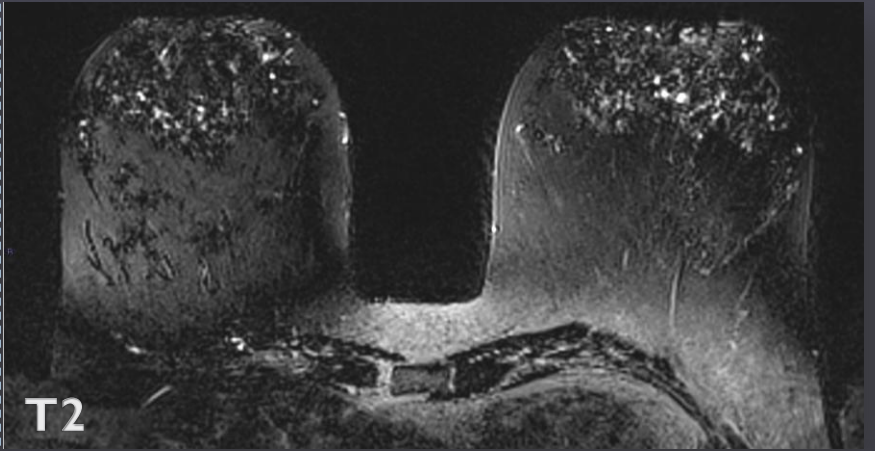
44 yo, staging of a right breast cancer

53 yo, distortion in the upper quadrants of the left breast

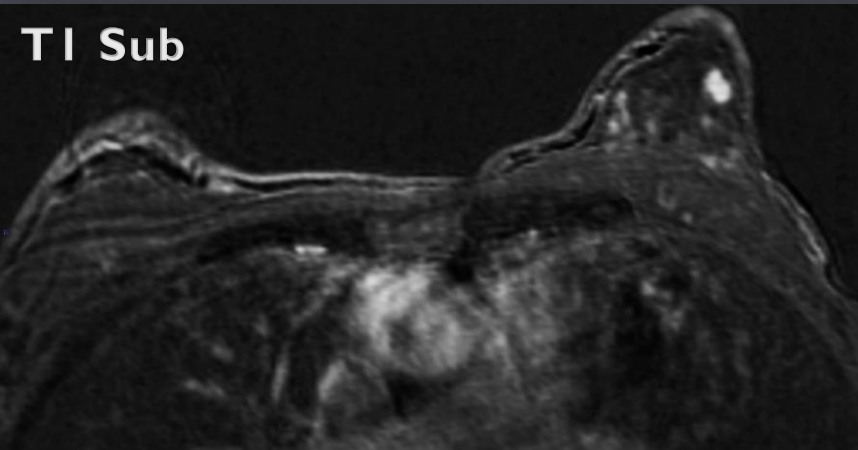
T2



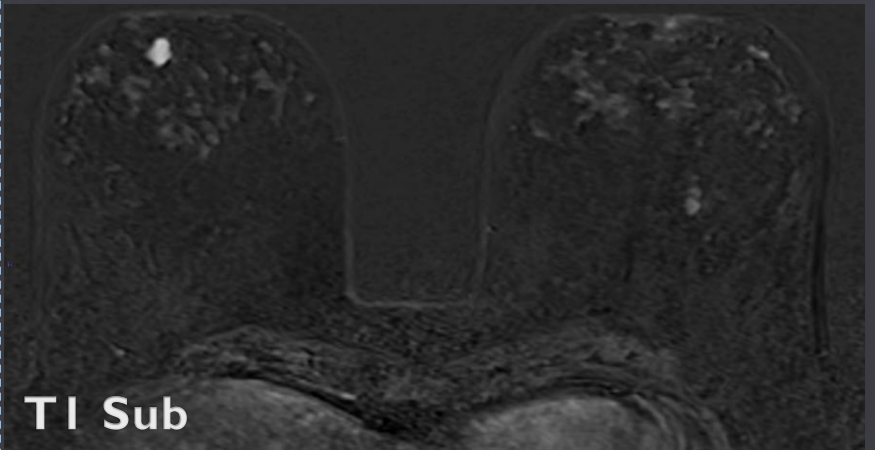
T2



T1 Sub



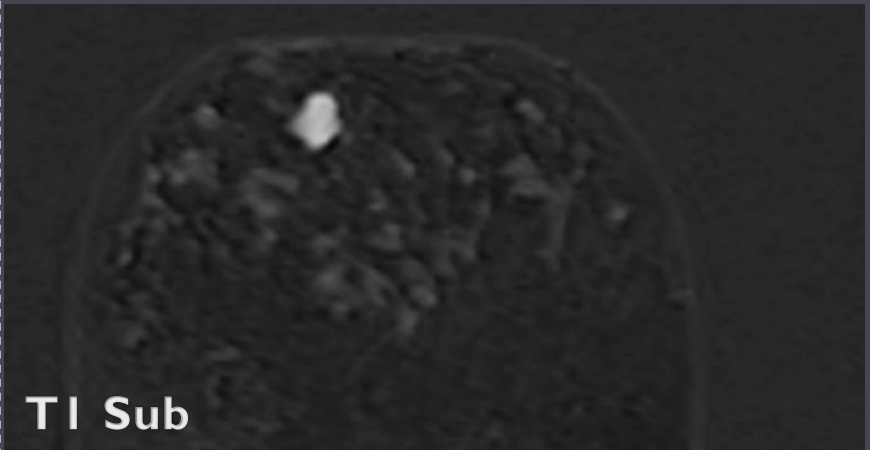
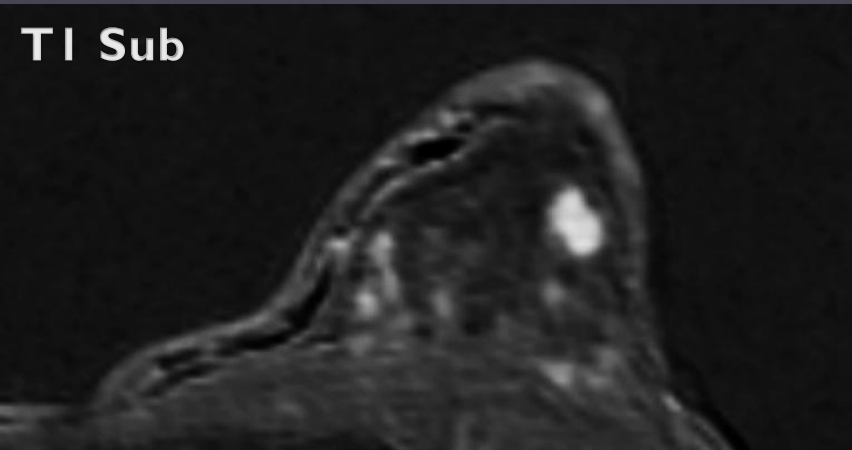
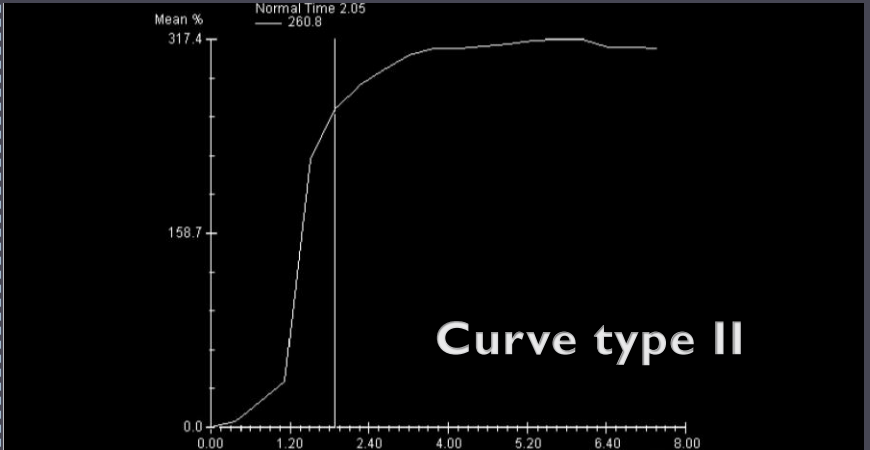
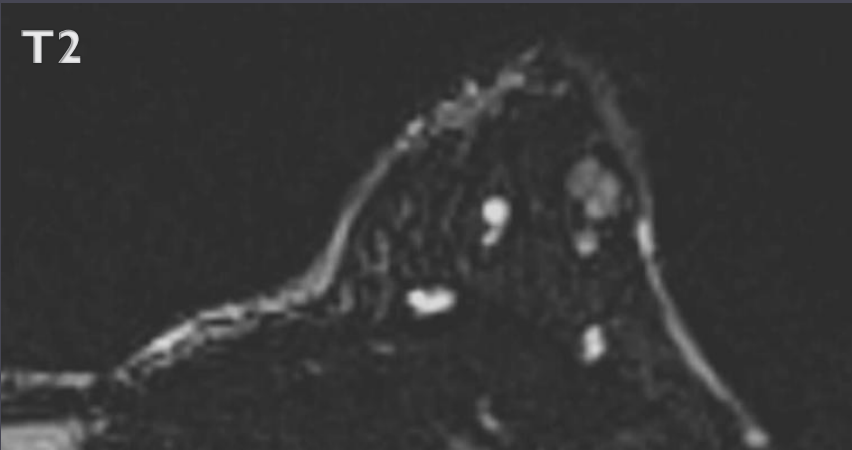
T1 Sub



MRI Findings

44 yo, staging of a right breast cancer

53 yo, distortion in the upper quadrants of the left breast



Fibrous Dystrophy

Dystrophy with atypical ductal hyperplasia

