

Benign Mimics of Malignancy on Breast Imaging

*MM Tyminski, DO; JE Watkins, MD, ET Ghosh, MD;
R Hultman, DO; T Stockl, MD; SA MacMaster, MD*

Teaching Points:

1. Demonstrate benign entities of the female breast that can have malignant imaging features.
2. Review mammography, ultrasound, and MRI findings with pathology correlation.
3. Recognize that many benign lesions can mimic breast cancer and should be included in differential diagnoses.
4. Reinforce importance of radiology and pathology correlation for these lesions in an effort to obviate unnecessary surgical intervention.

Outline

The following diagnoses will be reviewed:

Benign:

- Stromal Fibrosis
- Sclerosing Adenosis
- Tubular Adenoma
- Granular Cell Tumor
- Fat Necrosis
- Fibroadenoma
- Hemangioma

Benign but High Risk:

- Papillomas & Papillomatosis
- Radial Scar
- Benign Phyllodes

Benign Inflammatory:

- Diabetic Mastopathy
- Granulomatous Mastitis

Benign Diagnoses

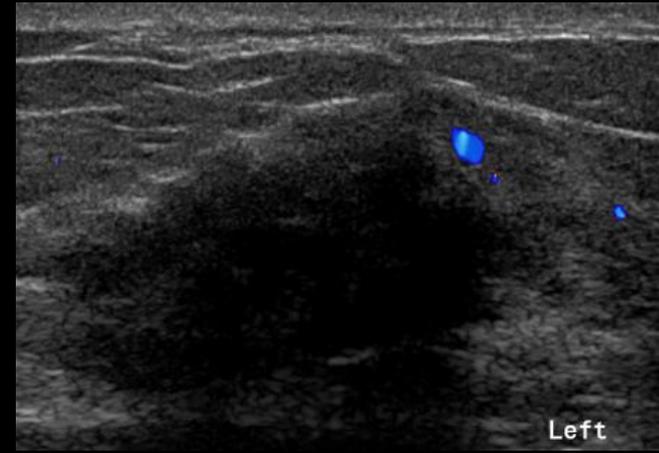
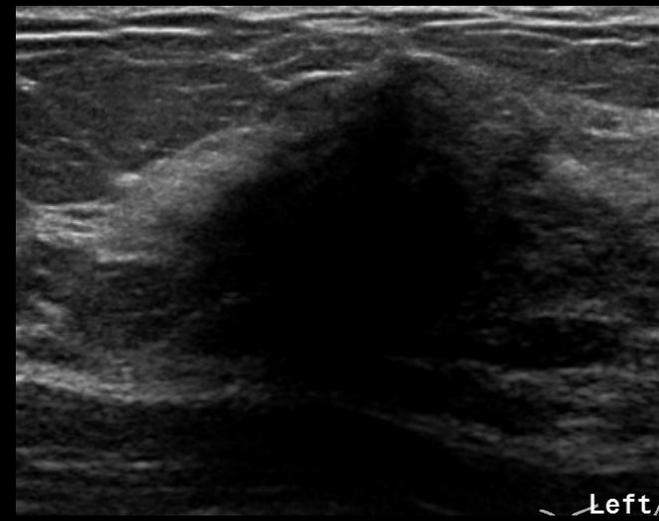
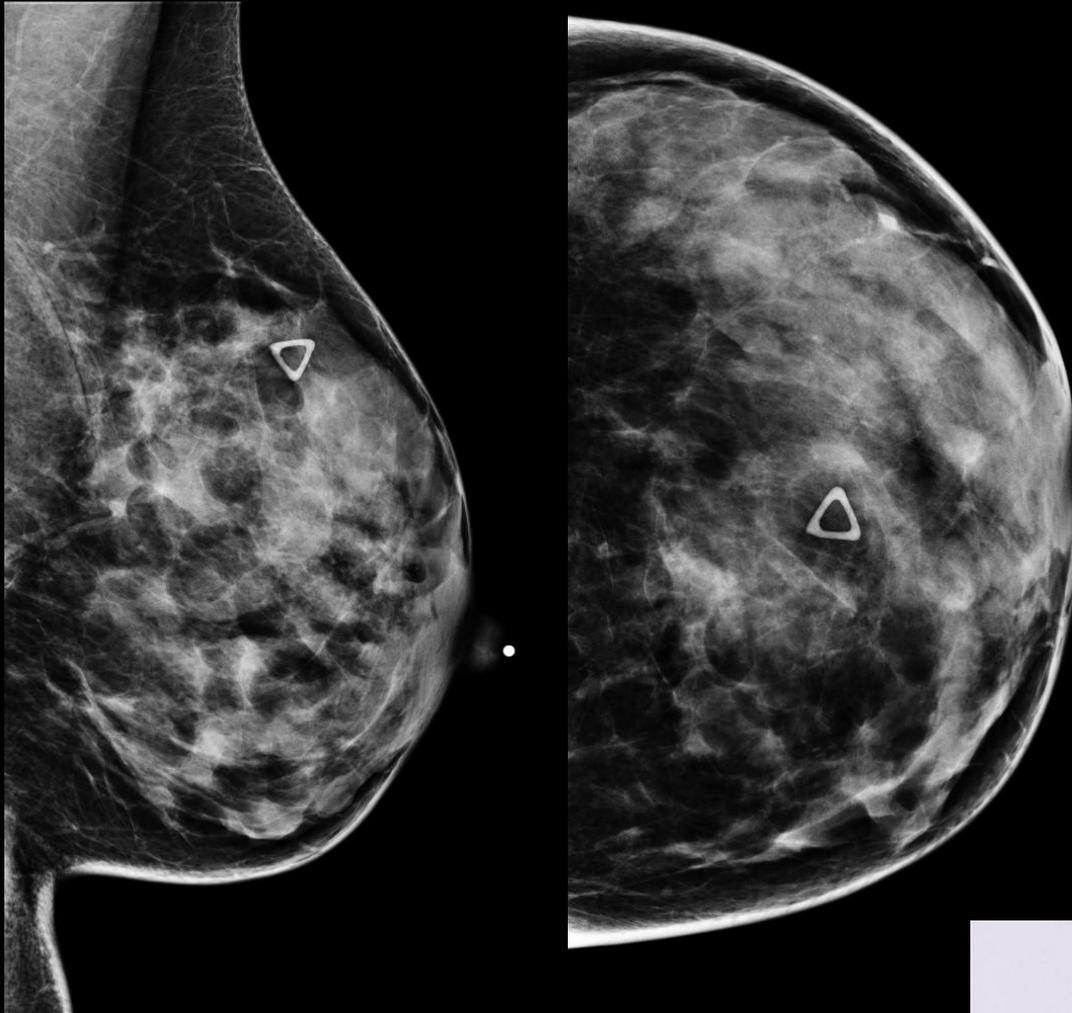
Stromal Fibrosis

- Proliferation of fibrous stroma replacing normal connective tissue and causing obliteration and atrophy of mammary ducts and lobules.
- Results in localized fibrous tissue and hypoplastic mammary ducts and lobules with an appearance that can mimic malignancy.
- Can present as a palpable mass or as a clinically occult incidental mammographic or sonographic abnormality.
- Found in approximately 2–10% of core needle biopsies
- There is no associated risk of malignancy and therefore no treatment is required.

Imaging Appearances:

- Mammogram
 - Variable and may appear as an asymmetry, mass, architectural distortion or can be mammographically occult.
 - May have associated calcification.
- Ultrasound
 - Most frequently appears as an irregular hypoechoic mass.
 - May show marked posterior shadowing.
- MRI
 - Isointense to breast parenchyma on T1 and STIR.
 - Can enhance post contrast and appear as an irregular mass or area of non-masslike enhancement .
- PET/CT
 - Can demonstrate increased uptake of F18-FDG leading to false positives.

Stromal Fibrosis

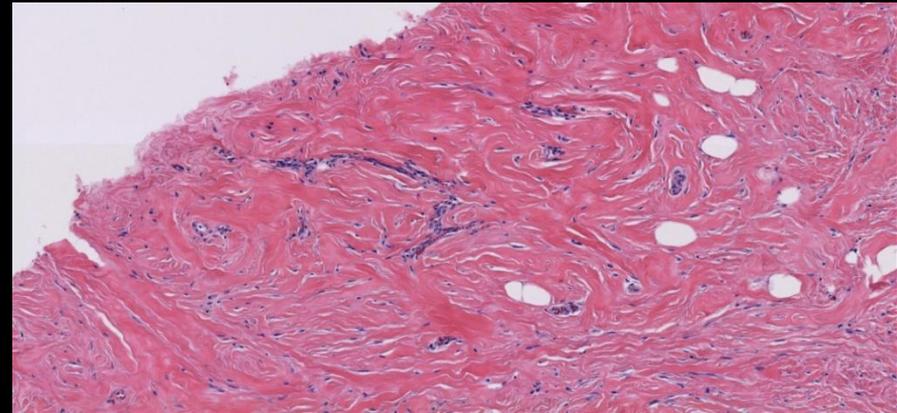


36 F presents with palpable mass:

Mammogram: Dense breast tissue. No mass at site of triangular palpable marker.

Ultrasound: 12:00, 19 x 12 x 14 mm hypoechoic mass with posterior shadowing, angular margins, no associated vascularity.

Pathology: Scattered benign ducts within dense stromal collagen arranged in a nodular, lobulocentric pattern.



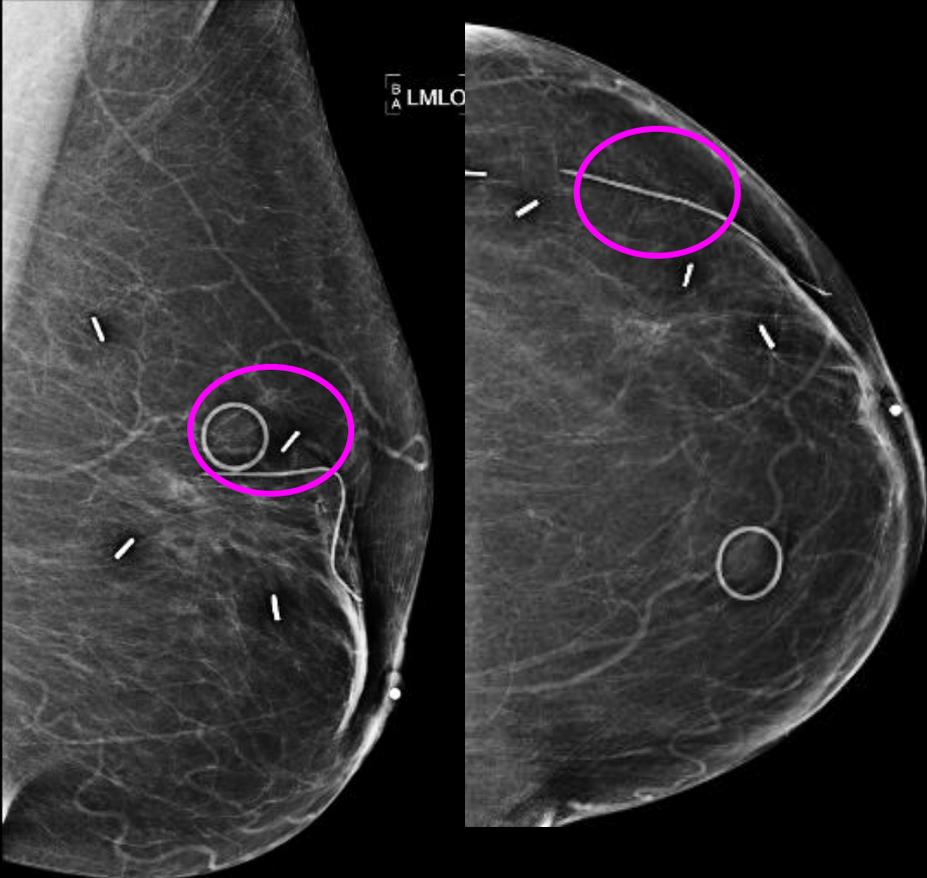
Sclerosing Adenosis

- Sclerosing adenosis of the breast is a benign proliferative lesion characterized by an increased number and size of glandular components involving the lobular units with disordered acinar, myoepithelial, and connective tissue elements.
- Sclerosing adenosis is present in 12% of benign surgical biopsies.
- Sclerosing adenosis is not considered a premalignant lesion, although there are some studies which suggest an increased lifetime risk of breast malignancy in these patients.
- No further treatment required if the pathology is concordant with the imaging findings.

Imaging Appearances:

- Mammogram
 - Most commonly presents as calcifications with clustered punctate, amorphous and pleomorphic as the most frequently encountered pattern.
 - Can appear as a mass or asymmetry.
- Ultrasound
 - Commonly appears as an oval, often circumscribed, hypoechoic solid mass.
 - Sometimes demonstrates echogenic calcifications.
 - May demonstrate increased vascularity.
- MRI
 - Usually indistinguishable from the background breast parenchyma

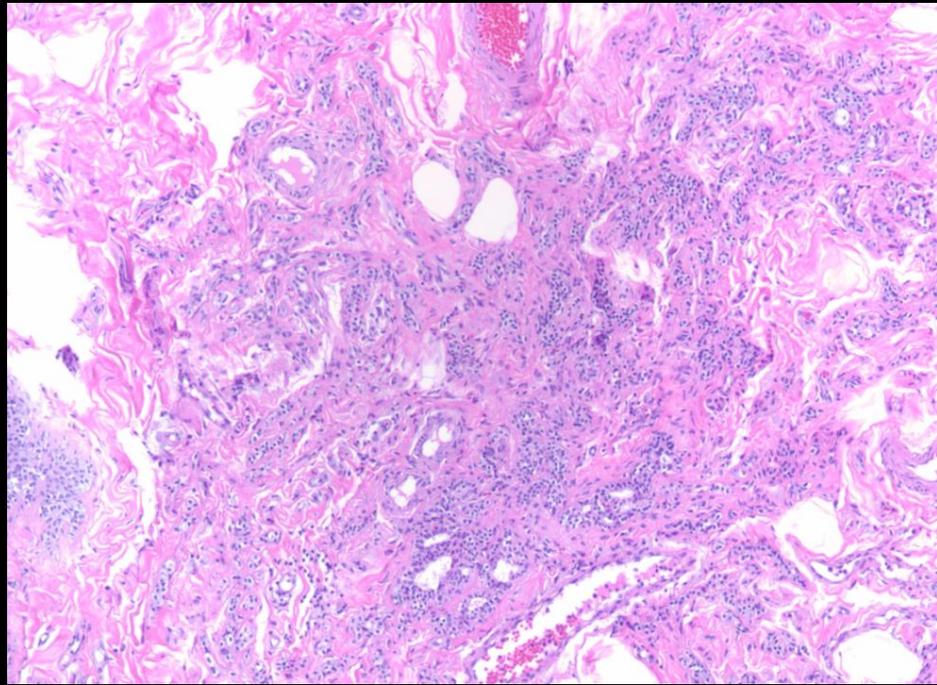
Sclerosing Adenosis



81 F status post lumpectomy for ductal carcinoma in situ now with new calcifications in the lumpectomy bed:

Mammogram: Post lumpectomy changes in the upper outer breast. On magnification views (ML shown upper right above), there are grouped faint punctate and amorphous calcifications directly lateral and superior to the lumpectomy bed suspicious for recurrent ductal carcinoma in situ.

Pathology: Sclerosing adenosis. This lobular unit shows duct atrophy and periductal fibrosis with maintained lobulocentric architecture.



Tubular Adenoma

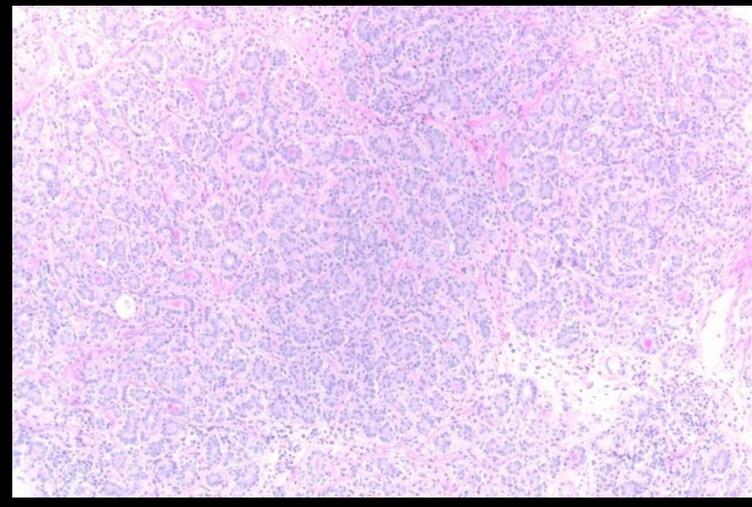
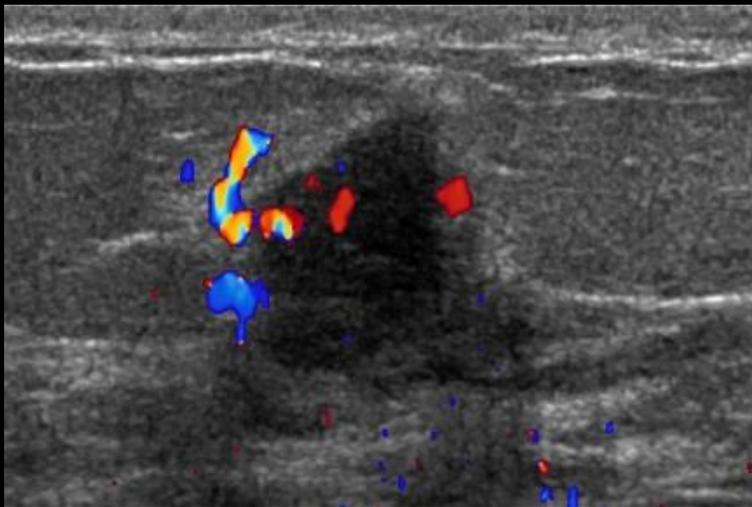
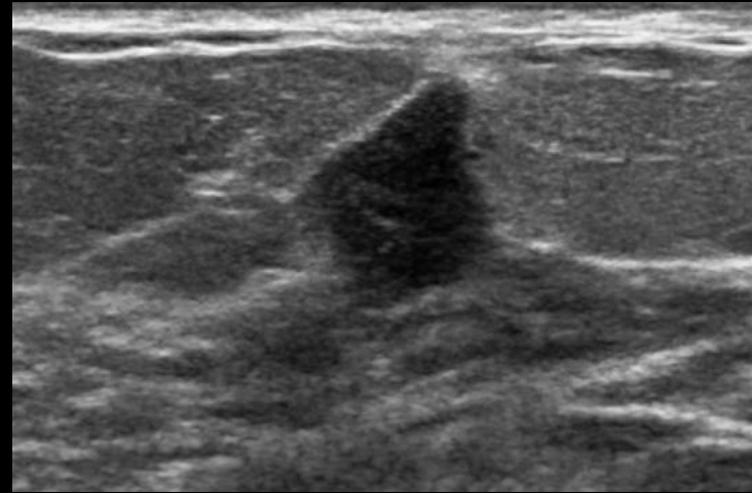
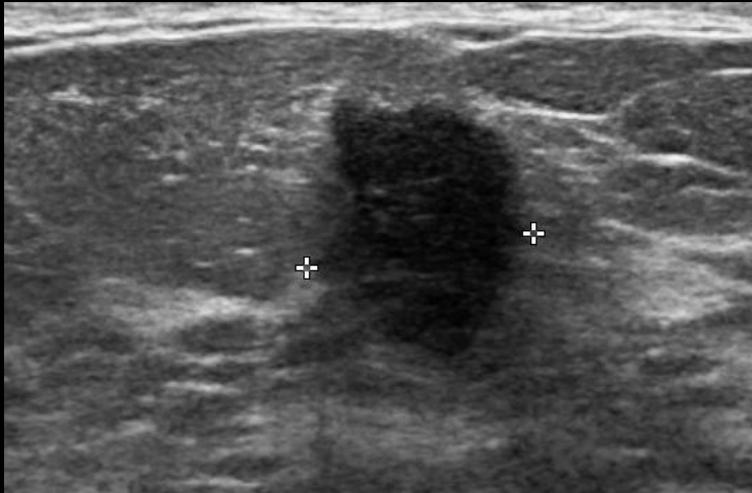
- Benign epithelial lesion composed of tightly packed tubular and acinar components with sparse associated intervening stroma.
- Rare.
- Can be asymptomatic or present as a palpable lump at breast exam.
- Most commonly found in young women of reproductive age.
- There is no associated risk of malignancy and therefore no treatment is required.
- Rarely these tumors can grow to a large size necessitating surgical excision for patient comfort.

Imaging Appearances:

- Mammogram
 - Most commonly circumscribed oval or round mass.
 - Can have associated punctate or amorphous calcifications.
- Ultrasound
 - Most commonly homogeneous, slightly hypoechoic, circumscribed oval or lobulated mass.
 - Demonstrate internal vascularity on color Doppler imaging.
- MRI
 - Usually homogeneously enhancing
 - T2-hyperintense circumscribed mass

Tubular Adenoma

Case 1



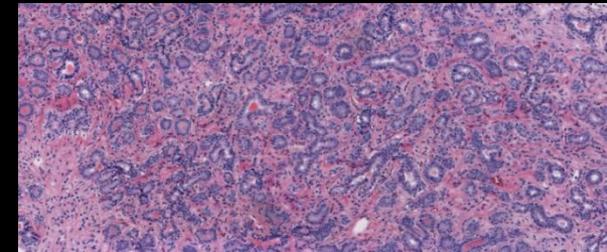
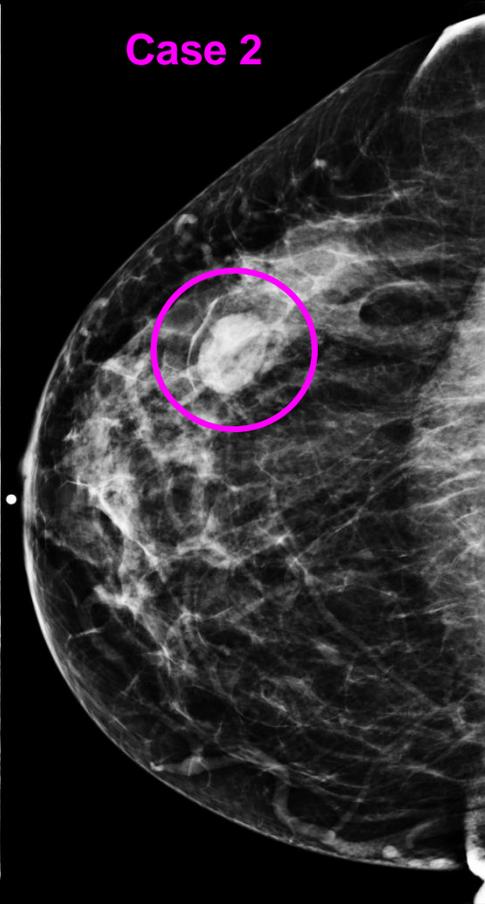
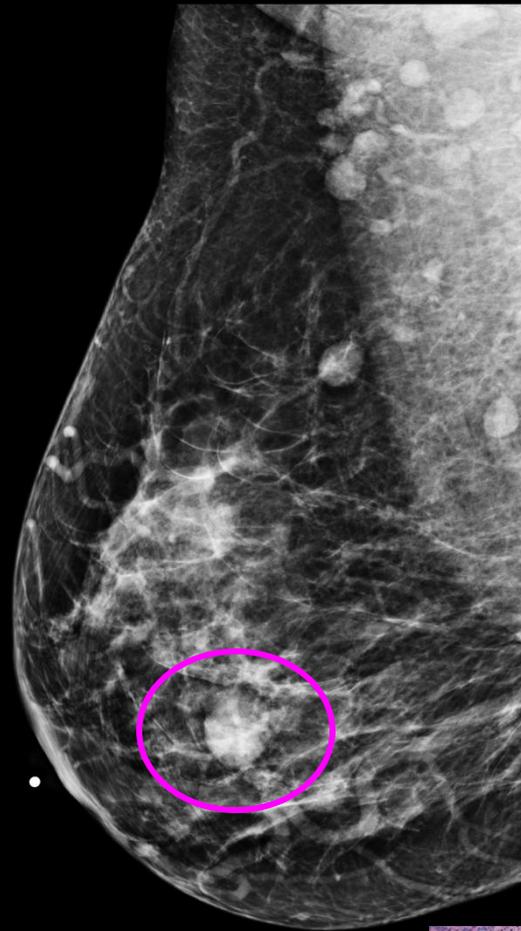
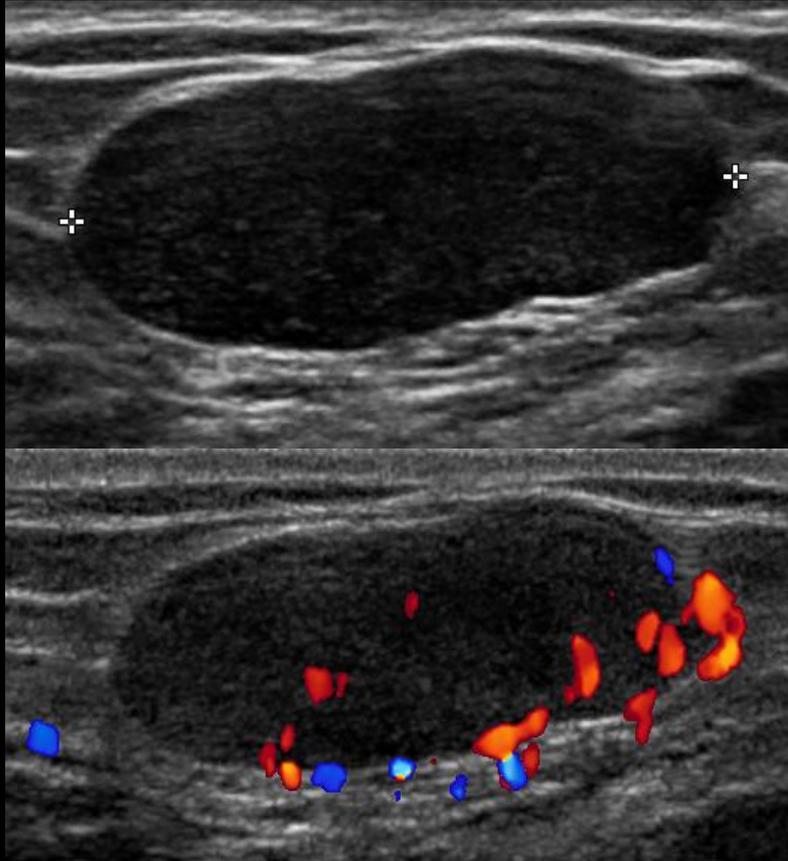
20 F presents with palpable breast lesion:

Mammogram: Not performed due to patient's age.

Ultrasound: Hypoechoic irregular mass measuring 8 x 10 x 9 mm, microlobulated margins, antiparallel orientation, with internal vascularity on color Doppler imaging.

Pathology: Tubular adenoma with closely packed small round ducts/tubules with little intervening stroma

Tubular Adenoma



43 F with mass on baseline screening mammogram:

Mammogram: Oval, circumscribed mass lower outer quadrant mid depth. Incidental note of multiple morphologically normal intramammary and axillary lymph nodes on MLO view (ultrasound proven).

Ultrasound: 17 x 9 x 21 mm hypoechoic, circumscribed, oval mass with parallel orientation, increased through transmission, and internal vascularity.

Pathology: Closely packed tubular structures with little innervating stroma and well defined border.

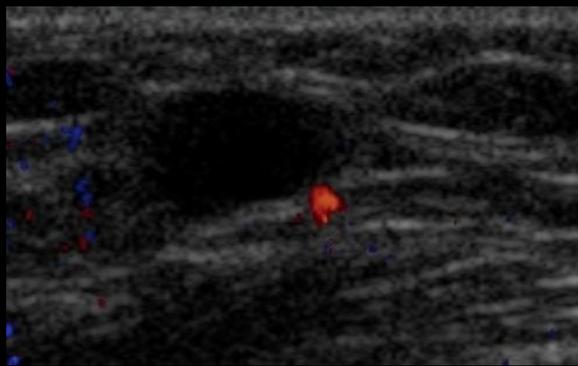
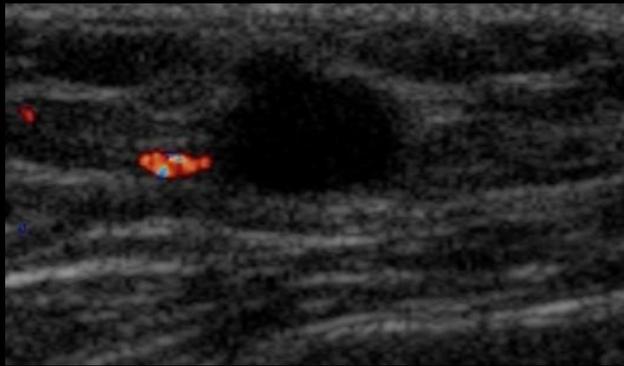
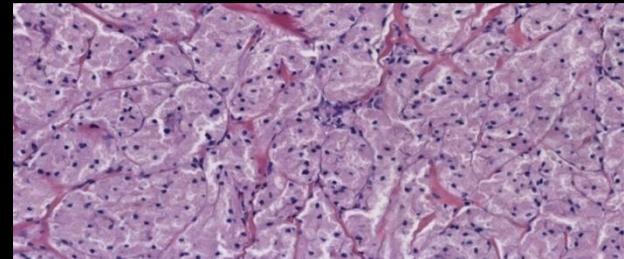
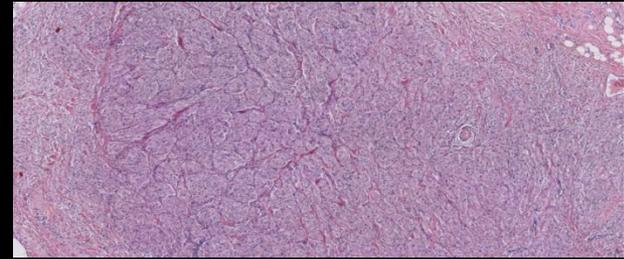
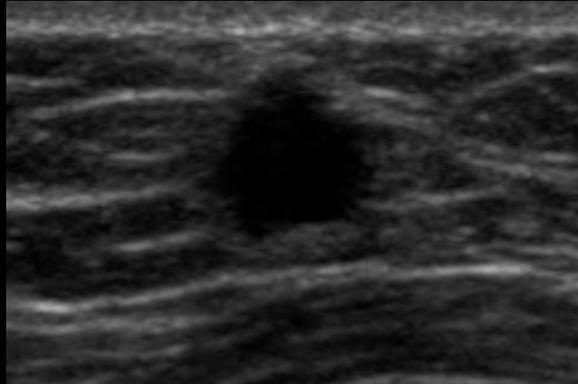
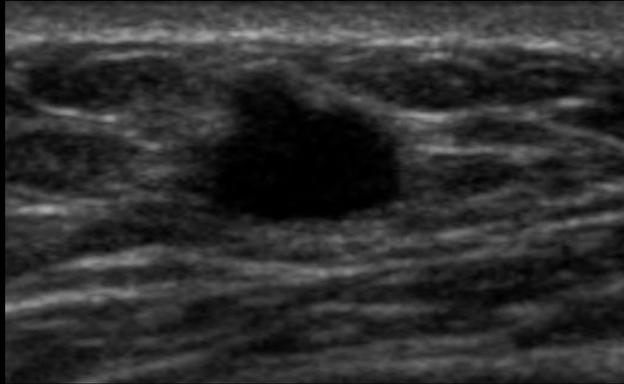
Granular Cell Tumor

- Granular cell tumor (GCT) is of Schwann cell origin.
- Can occur anywhere in the body, with the tongue the most common site. Approximately 5 to 6% of cases occur in the breast.
- Occur most frequently in the upper inner quadrant of the breast.
- Usually middle-aged, premenopausal females.
- Usually benign although rarely GCT can be malignant, determined at time of pathology evaluation.
- No treatment is necessary for benign GCTs.

Imaging Appearances:

- Mammogram
 - Most commonly an irregular, spiculated mass without calcifications.
- Ultrasound
 - Irregular, hypoechoic mass with angular margins and posterior shadowing.
 - Usually no internal vascularity on color Doppler imaging.
- MRI
 - Usually appears as an irregular, spiculated enhancing mass that mimics malignancy.
 - Variable enhancement characteristics. Can see rim, heterogeneous, or homogeneous enhancement.

Granular Cell Tumor



43 F with palpable lesion in the right breast:

Mammogram: Mammogram demonstrates an irregular mass in the upper inner quadrant (images not shown).

Ultrasound: 9 x 7 mm irregular hypoechoic mass with angular margins, no posterior features, and no internal vascular flow on color Doppler imaging.

Pathology: Well circumscribed tumor with lobular nested architecture. High power shows nests of cells with small nuclei and abundant granular eosinophilic cytoplasm. This is consistent with benign granular cell tumor of the breast.

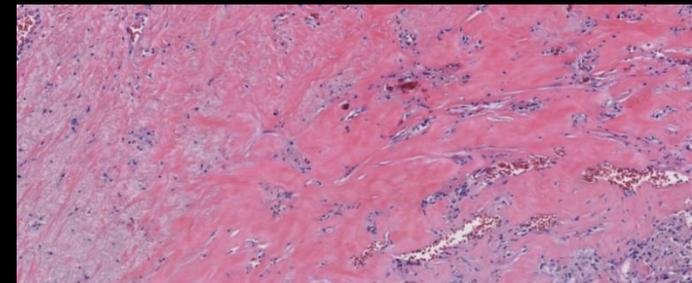
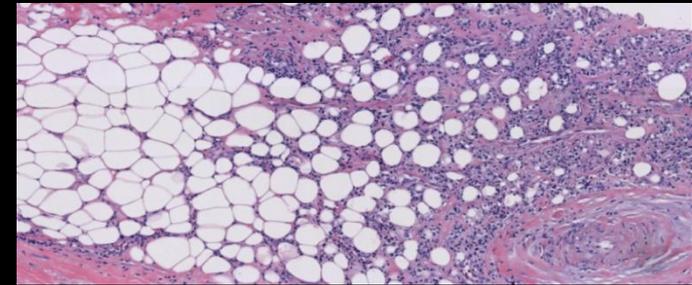
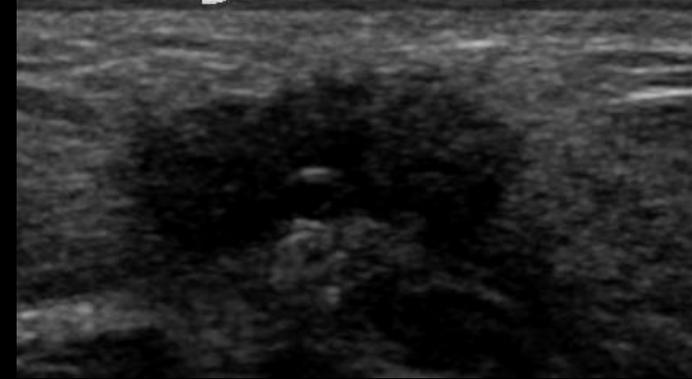
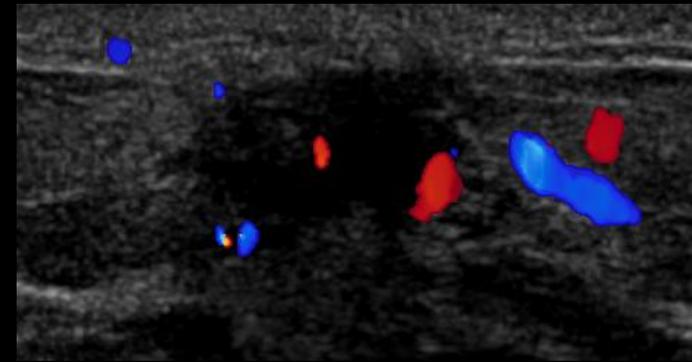
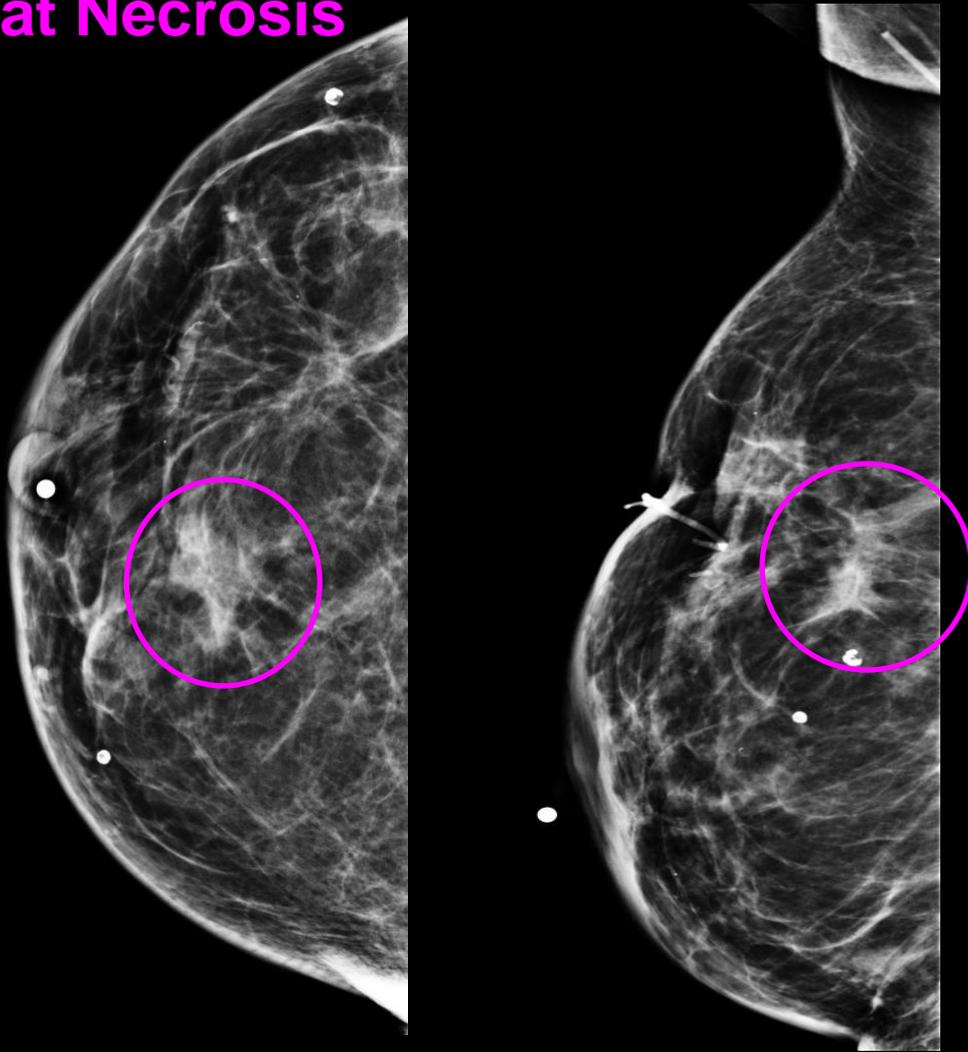
Fat Necrosis

- Very common entity in the breast that can result from prior trauma, surgery, or radiation therapy.
- Occurs when hemorrhage or inflammation causes damage to adipose tissue leading to fibrosis, calcification, and encapsulation of this process.
- Often incidental finding on imaging, however can present as a palpable mass.
- No treatment is required.

Imaging Appearances:

- Mammogram
 - Fat necrosis can present as oil cysts, coarse or micro-calcifications, asymmetries, or masses with spiculation.
 - Usually show classic progression over time with coarsening or dystrophic appearance of the calcification.
- Ultrasound
 - Can appear as a solid mass, complex mass with solid and cystic components, or vague area of distortion.
 - Variable echogenicity.
- MRI
 - Variable with many features that overlap malignancy.
 - Can see enhancing mass, sometimes with washout kinetics.
 - Can see architectural distortion associated with fibrosis.

Fat Necrosis



70 F remote history of breast cancer and prior lumpectomy:

Mammogram: Developing asymmetry upper inner breast mid depth.

Ultrasound: Hypoechoic, irregular mass with posterior shadowing, indistinct margins, and vascular flow measuring 11 x 4 x 9 mm.

Pathology: Variable sized fat deposits surrounded by foamy histiocytes, lymphocytes and occasional multinucleated giant cells as well as areas of hyalinized fibrosis.

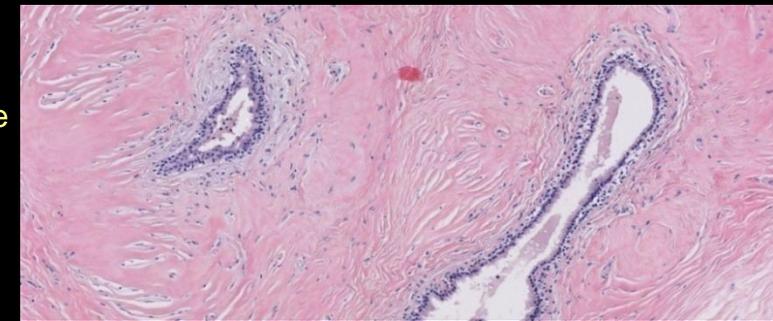
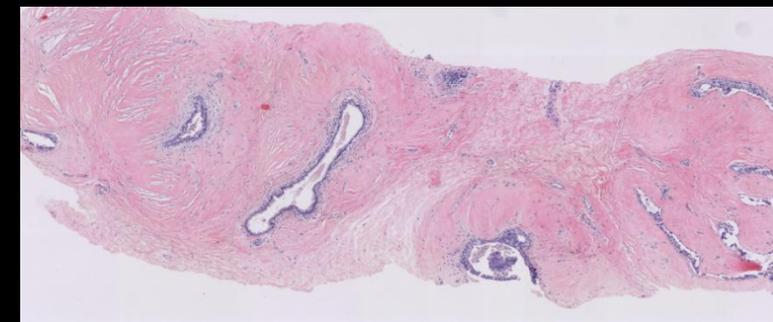
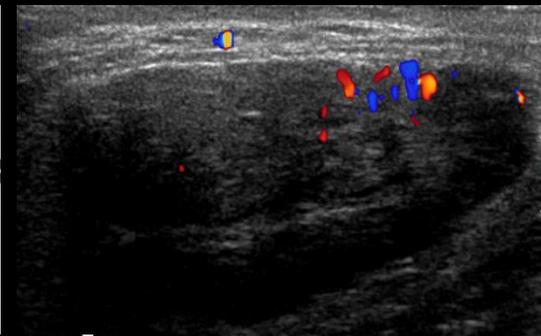
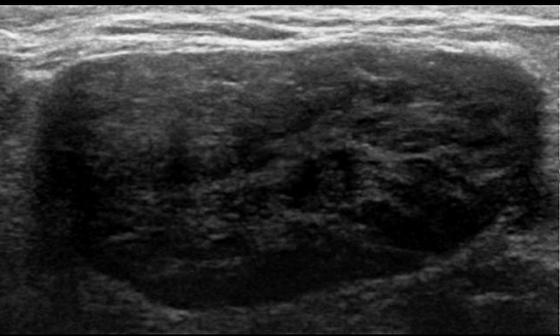
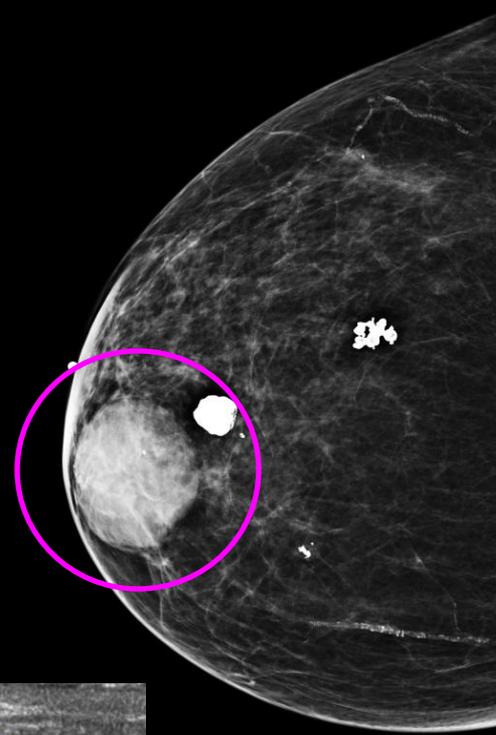
Fibroadenoma

- Most common benign breast tumor.
- Forms from the proliferation of epithelial and mesenchymal elements and stroma.
- Peak incidence between 15 and 35 years of age.
- Present as a palpable, mobile, firm, nontender mass.
- Hormone sensitive and can grow in response to pregnancy and estrogen therapy. Most spontaneously involute after menopause.
- No treatment is necessary unless rapidly growing or symptomatic.

Imaging Appearances:

- Mammogram
 - Circumscribed oval or round mass most common.
 - “Popcorn” calcifications are classic.
 - Calcifications often increase and coarsen over time.
- Ultrasound
 - Homogeneous, circumscribed, oval or lobulated, parallel mass.
 - May see peripheral feeding vessels or internal blood flow on color Doppler imaging, especially in larger lesions.
- MRI
 - T2 iso or hyperintense
 - Enhancing mass usually with progressive kinetics. Can see dark non-enhancing septations.
- PET/CT
 - Can demonstrate increased uptake of F18-FDG.

Fibroadenoma



72 F with history of colorectal cancer and palpable breast mass with abnormal uptake on PET:

Mammogram: Oval mass in the retroareolar region.

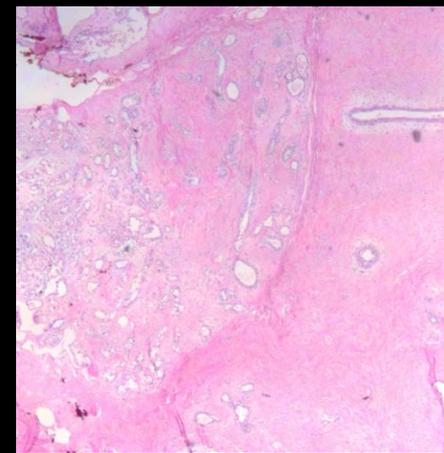
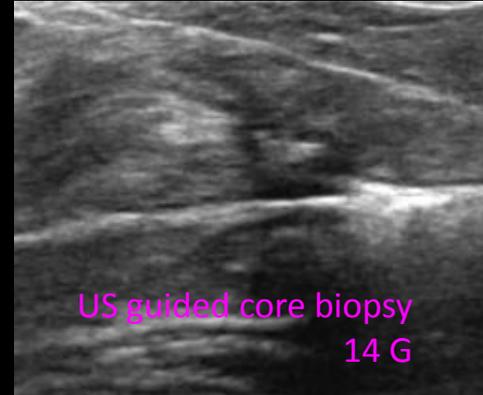
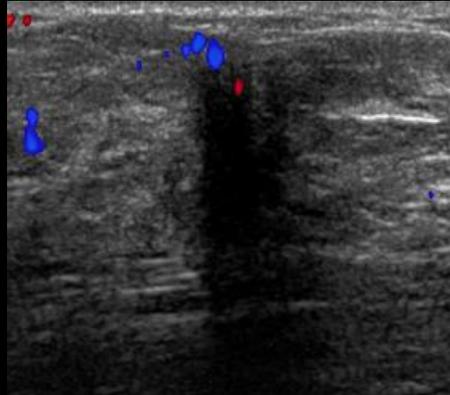
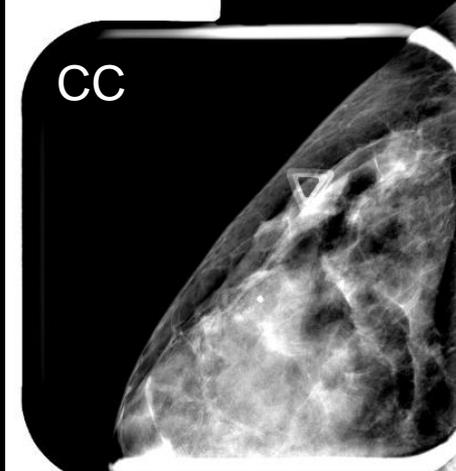
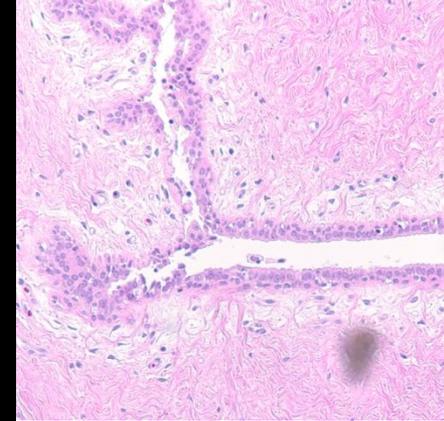
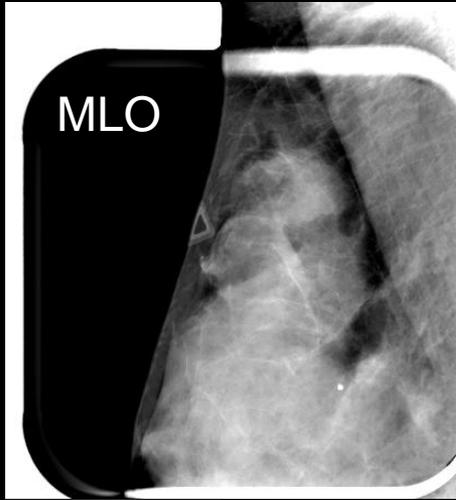
Ultrasound: 35 x 18 x 32 mm hypoechoic mass with internal vascularity at the palpable abnormality.

PET/CT: Circumscribed 3 cm right breast mass with increased F18-FDG uptake.

Pathology: Fibroadenoma with ducts that are compressed and elongated by an expanded hypocellular and hyalinized stroma without atypia.

Fibroadenoma

Case 2



41 F with palpable abnormality in the right breast:

Mammogram: MLO and CC spot compression views show extremely dense breast tissue without definite mass.

Ultrasound: 9 x 9 x 7 mm irregular hypoechoic mass with indistinct margins, posterior shadowing, and anti-parallel orientation.

Pathology: Fibroadenoma. Original pathology from the core biopsy was considered discordant with imaging features and excisional biopsy was recommended. Final pathology post surgery confirmed the diagnosis of fibroadenoma.

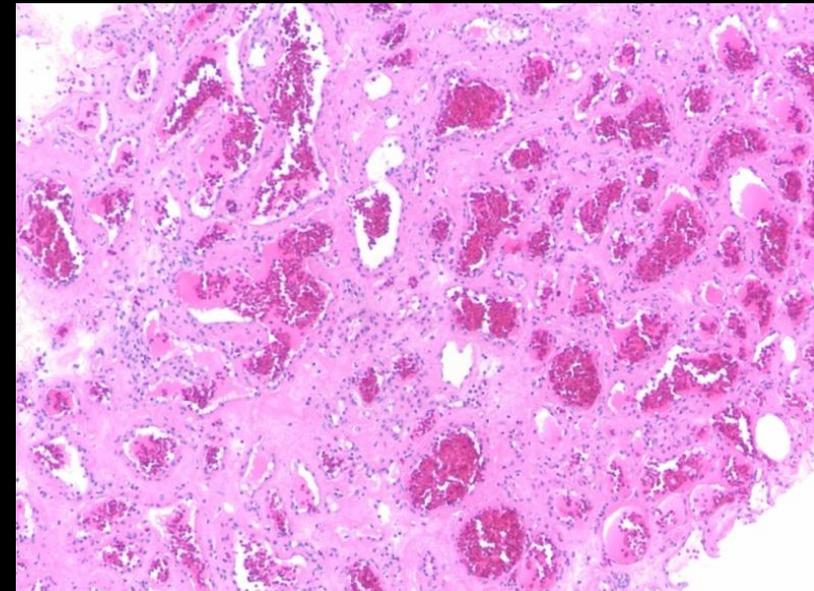
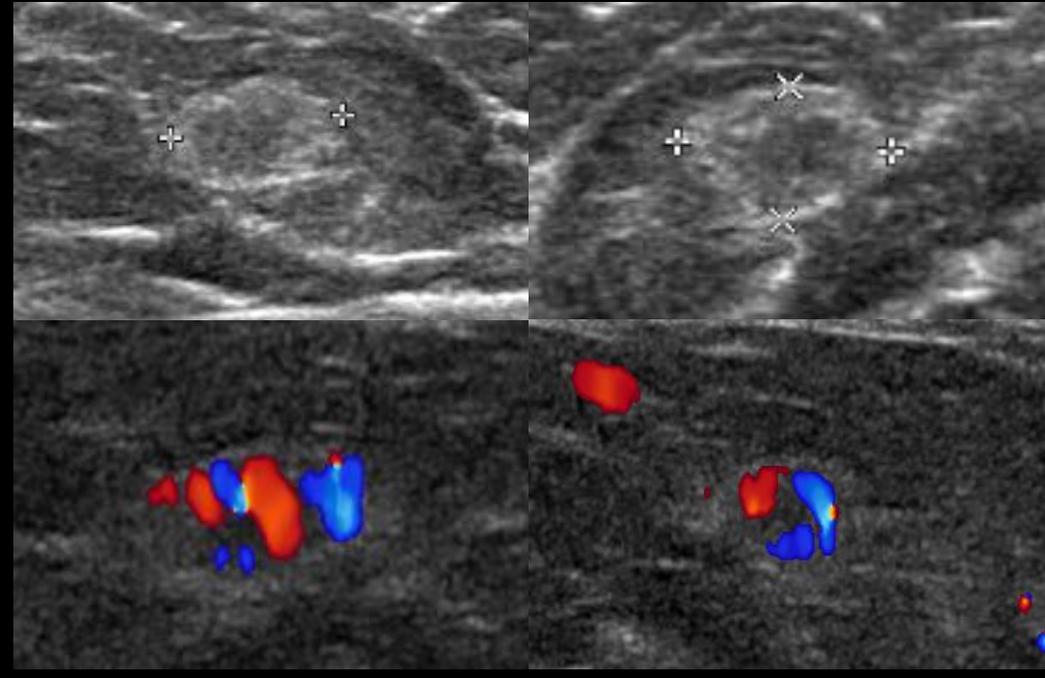
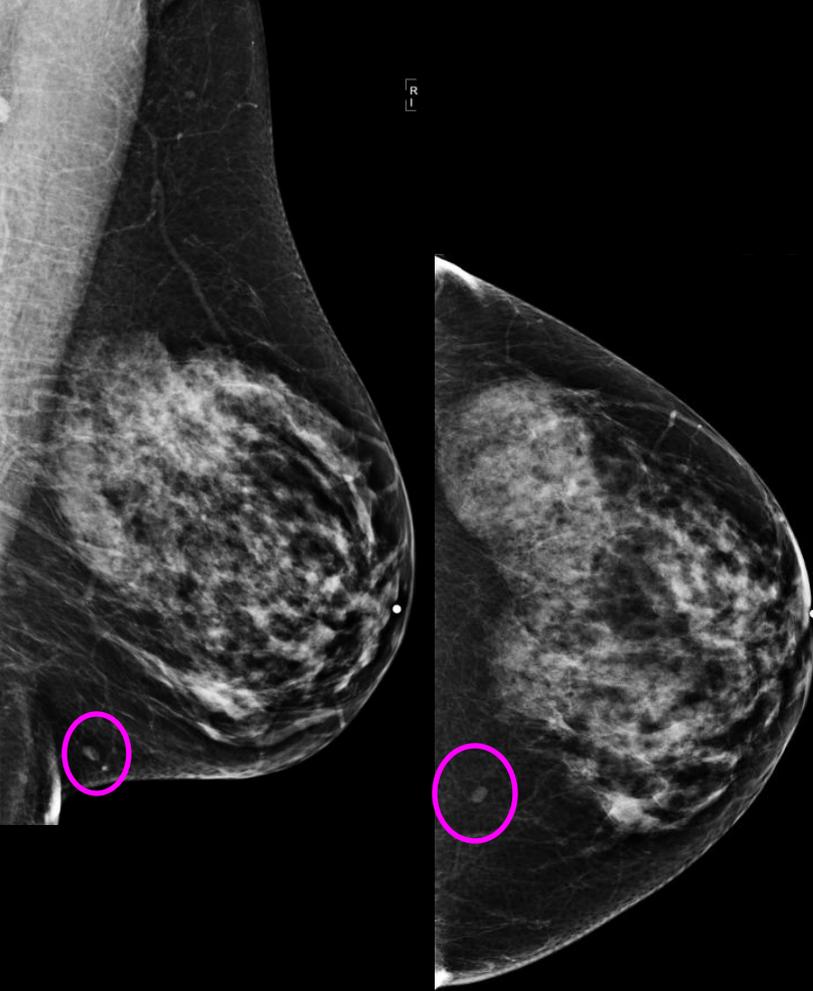
Hemangioma

- Benign vascular tumor that can occur anywhere in the body.
- Rare lesions of the breast, found in only 1.2% of mastectomy specimens. Both capillary and cavernous variants can be seen.
- Can be asymptomatic or present as a palpable mass.
- No treatment is necessary if pathology is concordant with imaging features.

Imaging Appearances:

- Mammogram
 - Usually appear as a circumscribed, oval mass.
 - May have associated punctate or coarse phlebolith calcifications.
- Ultrasound
 - Commonly in a superficial location.
 - Circumscribed oval mass with variable echotexture and echogenicity. Classically hyperechoic on ultrasound.
- MRI
 - Variable but sometimes can see similar MRI enhancement characteristics as hemangiomas in other parts of the body with early peripheral enhancement and delayed fill in of central enhancement.

Hemangioma of the Breast



50 F annual screening:

Mammogram: Circumscribed mass in the lower inner left breast which persists on spot compression views (not shown).

Ultrasound: Echogenic solid mass with marked vascular flow on color Doppler imaging at 8 o'clock 10 cm from the nipple measuring 6 x 4 x 6 mm, corresponding to the site of the mammographic mass.

Pathology: This benign vascular lesion consists of a proliferation of thin-walled vessels lined by flattened endothelial cells within a loosely cellular stroma

Benign High Risk Diagnoses

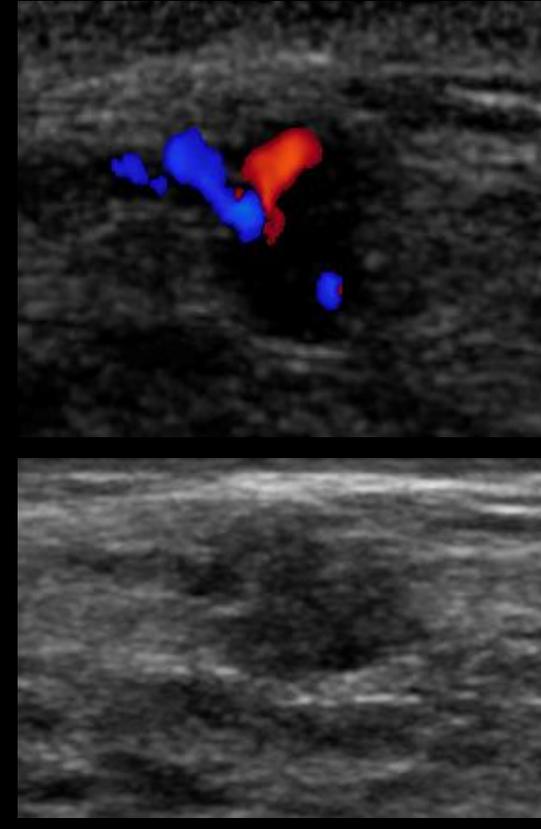
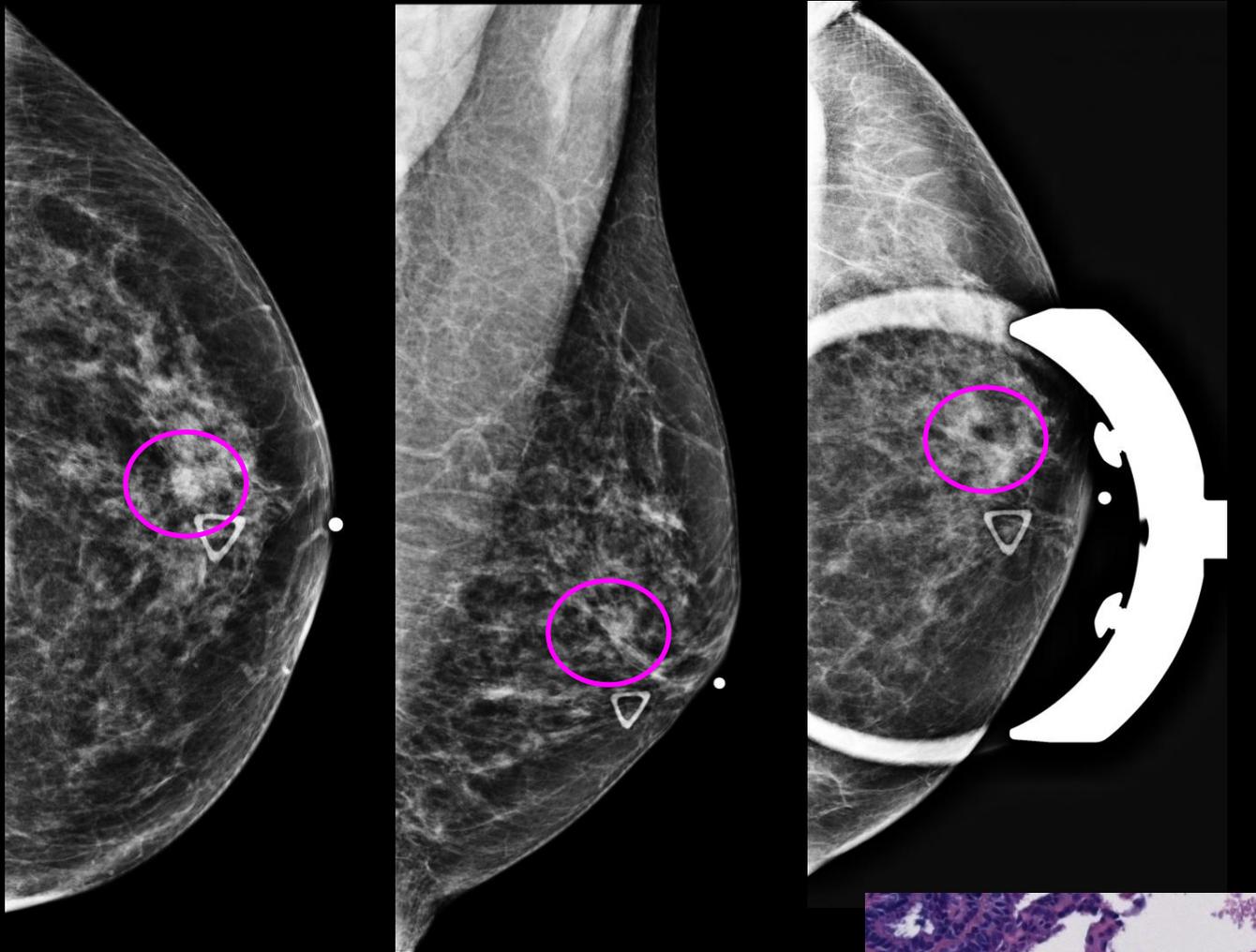
Papillomas & Papillomatosis

- Intraductal papillomas are benign tumors of mammary duct epithelium and can arise anywhere in the ductal system, central > peripheral.
- Papillomas are the most common cause of bloody nipple discharge.
- Present as a palpable mass, spontaneous serous or bloody nipple discharge, mass or asymmetry on mammogram or ultrasonound, or as a filling defect on ductography.
- Papillomatosis is defined as at least 5 papillomas within a segment of breast tissue, usually peripherally located within the breast.
- Papillomas can be associated with in-situ or invasive breast carcinoma, with the risk higher with peripheral papillomatosis than with a central papilloma.
- Management is surgical consultation for excision.

Imaging Appearances:

- Mammogram
 - Can appear as an asymmetry, mass, calcification, or can be mammographically occult.
- Ultrasound
 - Most commonly an intraductal mass with surrounding dilated ducts.
 - Usually demonstrate internal vascularity on color Doppler imaging, sometimes with hypervascular stalk.
- MRI
 - May see high signal on T1 due to blood products.
 - T2 hyperintense dilated ducts.
 - Variable enhancement kinetics.
 - Usually linear or clumped non-masslike enhancement.
- Ductography
 - Intraluminal filling defect.

Papilloma

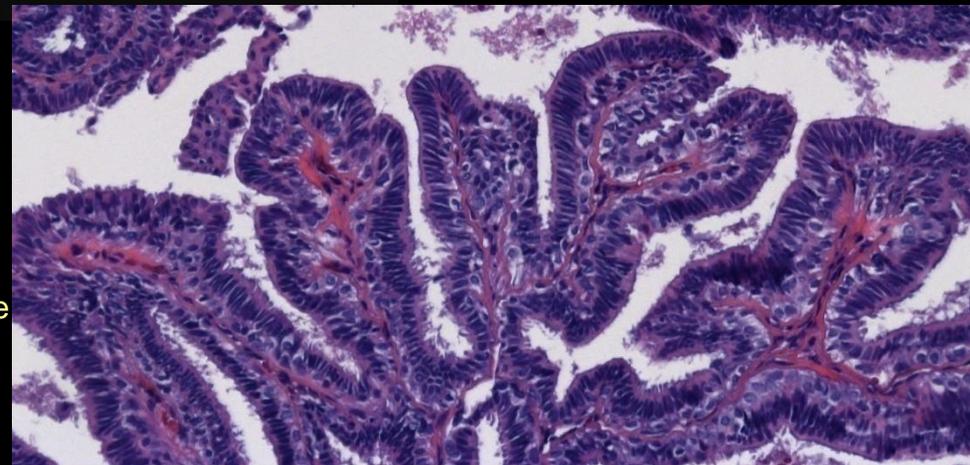


66 F with palpable left mass:

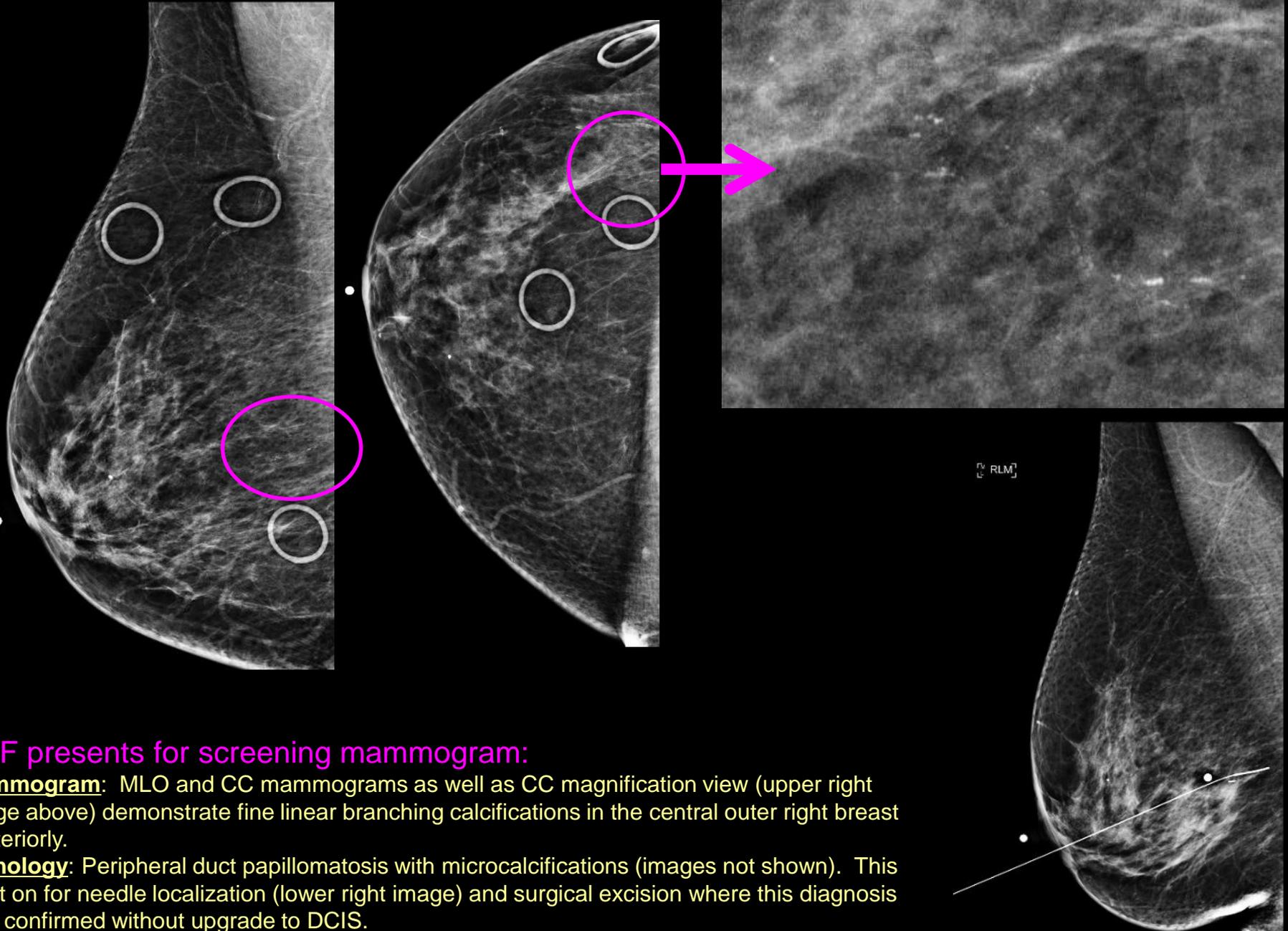
Mammogram: Subareolar focal asymmetry corresponding to palpable abnormality marked with triangular marker.

Ultrasound: 5 x 4 x 4 mm round hypoechoic mass, indistinct margins, with internal vascularity, no posterior features.

Pathology: Papillary proliferation within a cyst wall. The papillae are composed of branching fibrovascular cores lined by a dual cell layer including prominent layer of myoepithelial cells and overlying ductal epithelial cells with focal usual hyperplasia.



Peripheral Duct Papillomatosis



76 F presents for screening mammogram:

Mammogram: MLO and CC mammograms as well as CC magnification view (upper right image above) demonstrate fine linear branching calcifications in the central outer right breast posteriorly.

Pathology: Peripheral duct papillomatosis with microcalcifications (images not shown). This went on for needle localization (lower right image) and surgical excision where this diagnosis was confirmed without upgrade to DCIS.

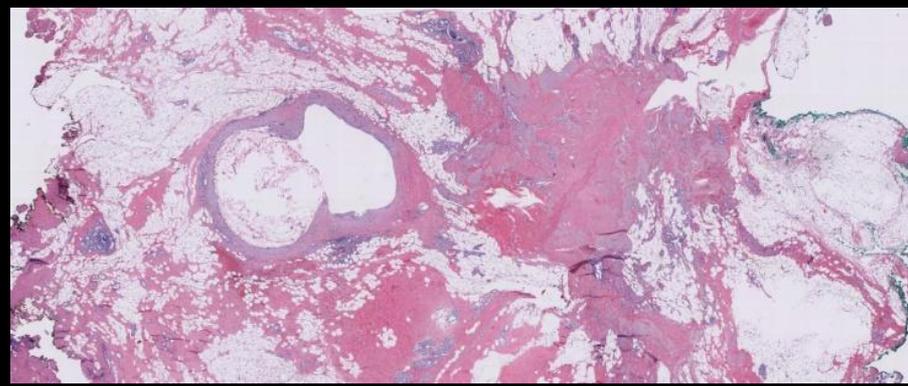
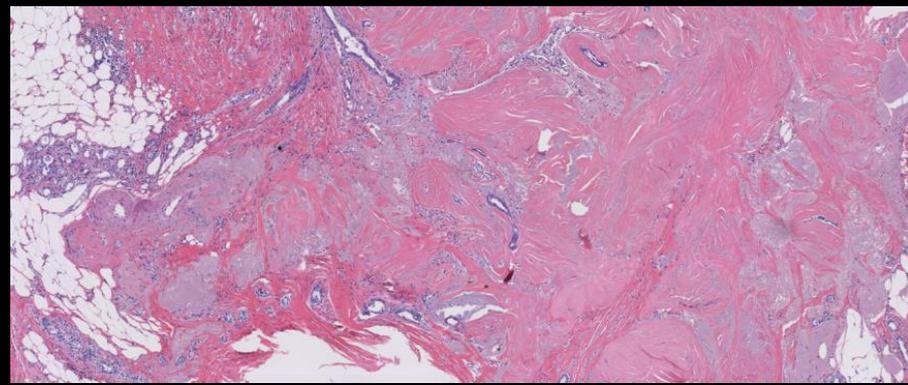
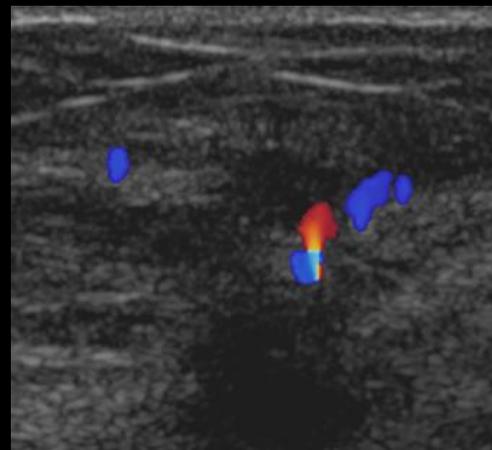
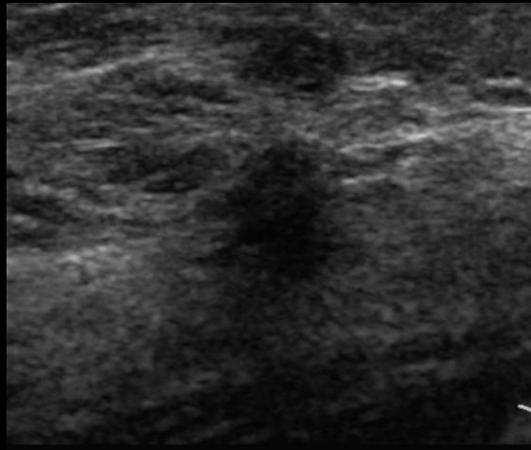
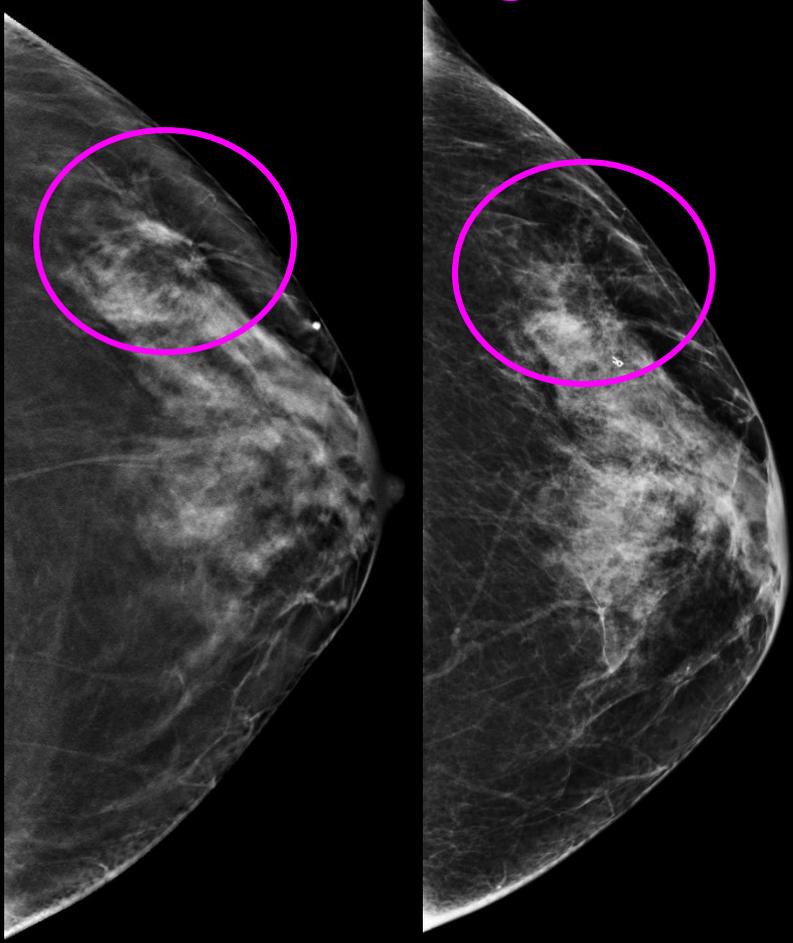
Radial Sclerosing Lesion

- Radial sclerosing lesion (RSL) refers to both radial scars and complex sclerosing lesions (CSL), CSL >1 cm.
- Pathologically, RSLs are a stellate array of proliferative ductal structures with sclerotic background and central fibroelastotic core.
- Most commonly asymptomatic and non-palpable lesions, incidentally discovered on mammography.
- Can be associated with ADH, DCIS, or invasive carcinoma (10-30%).
- Seen in approximately 5-16% of mastectomy specimens.
- Surgical excision is recommended.

Imaging Appearances:

- Mammogram
 - Classically see architectural distortion with long radiating spicules leading to a central lucency without a central mass.
 - Can have associated calcification.
 - No skin thickening or retraction.
- Ultrasound
 - Most commonly heterogeneous echotexture without discrete mass.
- MRI
 - Variable MRI appearances.
 - Can be non-enhancing, demonstrate non-masslike enhancement, appear as an enhancing mass, or as an area of architectural distortion.

Radial Sclerosing Lesion



63 F for follow-up post prior benign biopsy:

Craniocaudal Projection Tomosynthesis & Mammogram:

Focal architectural distortion in the lateral breast (arrows).

Ultrasound: 7 x 7 mm hypoechoic irregular solid mass with angular margins, posterior shadowing, and peripheral vascularity at 3:00 5cm from the nipple.

Pathology: Central fibroelastosis mixed with ducts of varying sizes and radiating finger-like projections into the surrounding breast parenchyma, consistent with radial sclerosing lesion

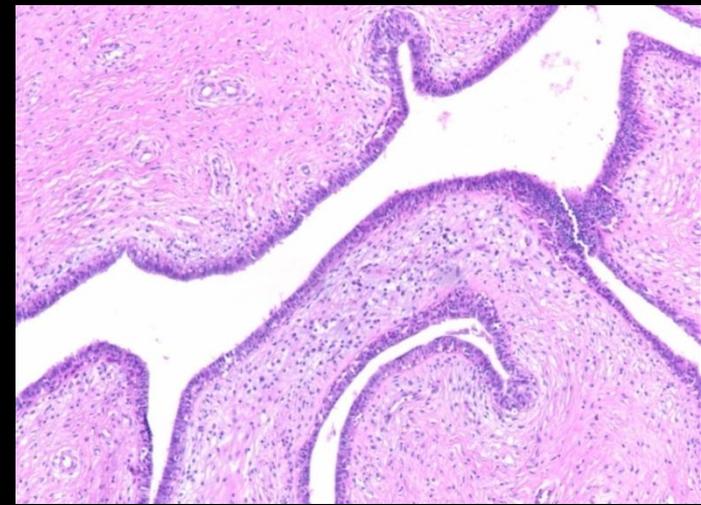
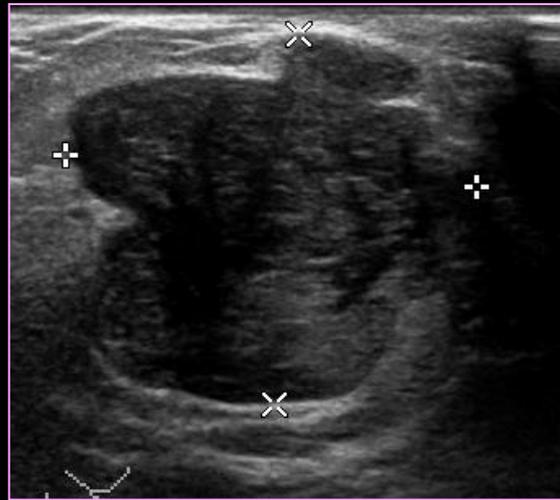
Benign Phyllodes

- Fibroepithelial tumors of the breast. Histologically made up of epithelial and stromal elements of the terminal duct lobular unit.
- Rare, phyllodes tumors make up ~1% of all primary breast tumors.
- Approximately 60% of phyllodes are benign, however these can grow rapidly. Histology within a single mass can vary with benign and malignant segments, allowing for sampling error at biopsy.
- May develop de novo or from existing fibroadenomas
- Treatment is with wide surgical excision as there is a high rate of local recurrence.

Imaging Appearances:

- Mammogram
 - Usually circumscribed round or oval mass.
 - Calcification rare.
- Ultrasound
 - Mimic fibroadenoma. Commonly appear as a circumscribed parallel, oval, round, or lobulated hypoechoic mass.
 - Internal vascularity on color Doppler imaging.
- MRI
 - Iso to hypointense on T1. May see areas of hemorrhage as high signal intensity on T1 weighted images.
 - Hyperintense on T2.
 - Avid contrast enhancement, sometimes with washout kinetics.
 - Can see non-enhancing internal septations and cystic spaces.

Benign Phyllodes Tumor



40 F palpable right breast lump:

Mammogram: MLO and CC views demonstrate an oval circumscribed mass in the area of the patient's palpable lump.

Ultrasound: Lobulated circumscribed mass measuring 21 x 19 x 18 mm corresponding to the mammographic mass in the retroareolar breast. Internal vascularity is demonstrated on color Doppler imaging.

Pathology: Phyllodes tumors are fibroepithelial lesions where classically, the proliferation of the cellular spindled stromal cells creates cleft-like spaces lined by two cell layers. Rare stromal mitoses, lack of atypia and lack of stromal overgrowth characterizes this example as a benign phyllodes tumor.

Benign Inflammatory Diagnoses

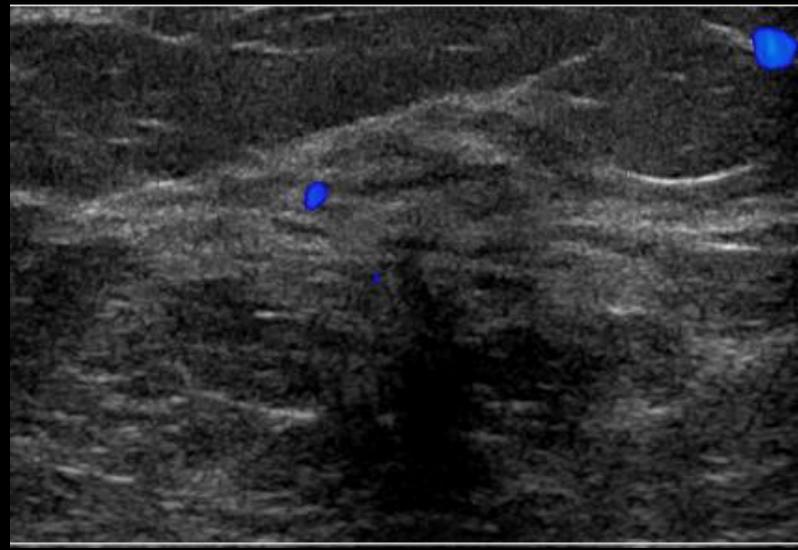
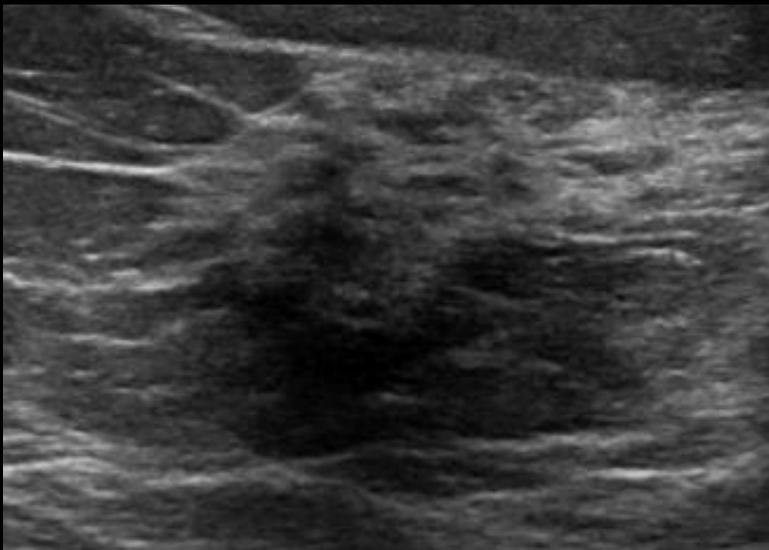
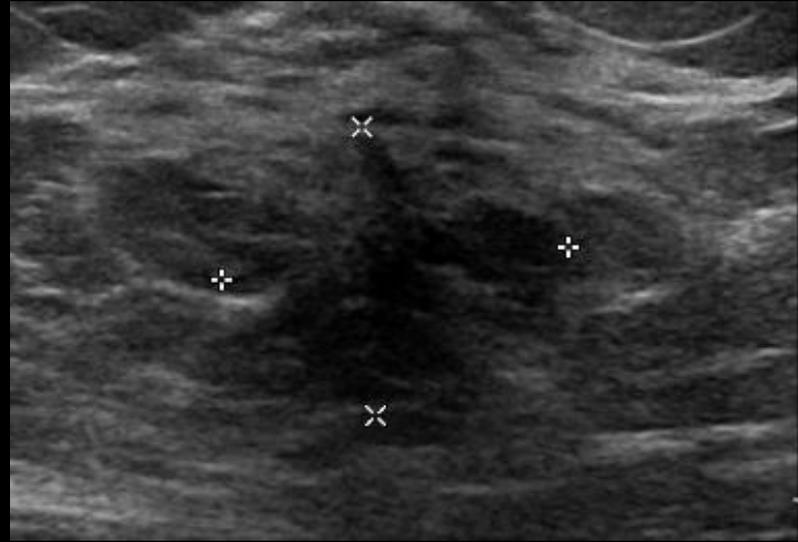
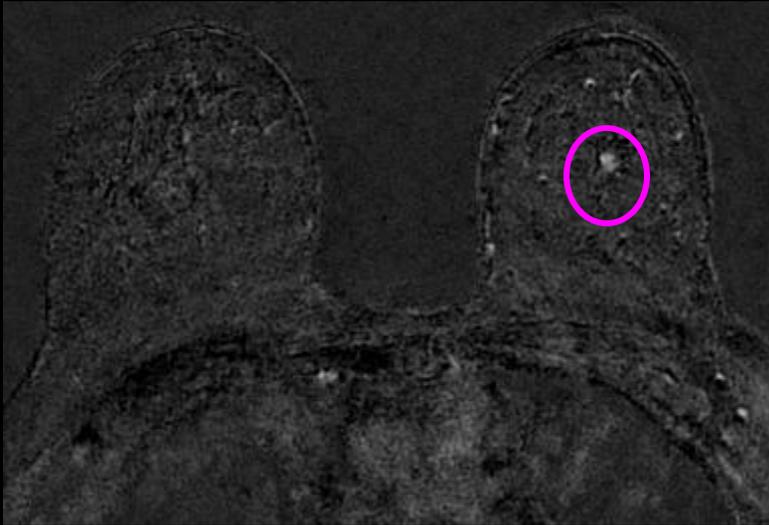
Diabetic Mastopathy

- A form of lymphocytic mastitis and stromal fibrosis of the breast found in diabetic patients.
- Usually seen in association with insulin dependent type 1 diabetes, although rarely can also be seen with long standing type 2 diabetes.
- Often presents as a hard, painless, irregular breast mass which can mimic breast cancer on clinical exam and imaging studies.
- Masses may be multiple and bilateral.
- This is a benign entity without malignant potential.
- No specific treatment is necessary for the breast mass besides treating the underlying diabetes.

Imaging Appearances:

- Mammogram
 - Most often appears as an asymmetry.
 - Usually no associated calcification.
 - Often occult in dense breasts.
- Ultrasound
 - Hypoechoic ill defined mass with marked posterior shadowing.
 - Usually no internal vascularity on color Doppler imaging.
- MRI
 - Fibrosis appears T2 hypointense.
 - Post contrast imaging demonstrates varying degrees of enhancement.
 - Cannot be differentiated from a malignancy.

Diabetic Mastopathy



39 F with type 1 diabetes, BRCA 1 positive presents for screening MRI:

MRI: Lobulated, enhancing mass at 12 o'clock 7cm from the nipple with mixed kinetics.

Ultrasound: 15mm x 12mm hypoechoic mass at 12 o'clock 7 cm from the nipple with angular margins, no posterior features or associated vascularity.

Pathology: Biopsy proven diabetic mastopathy. Pathology images not available.

Granulomatous Mastitis

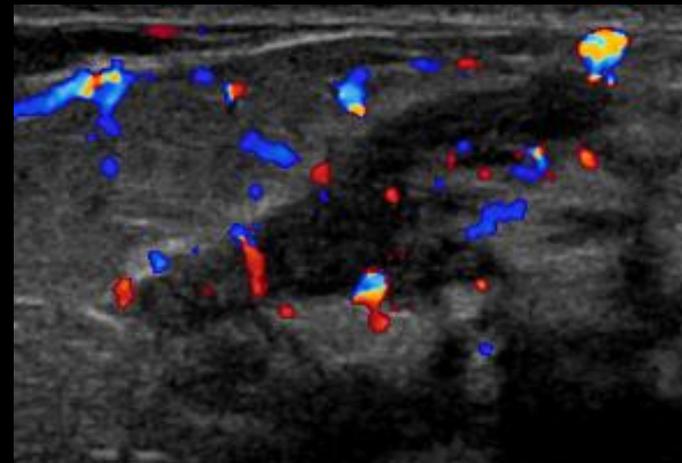
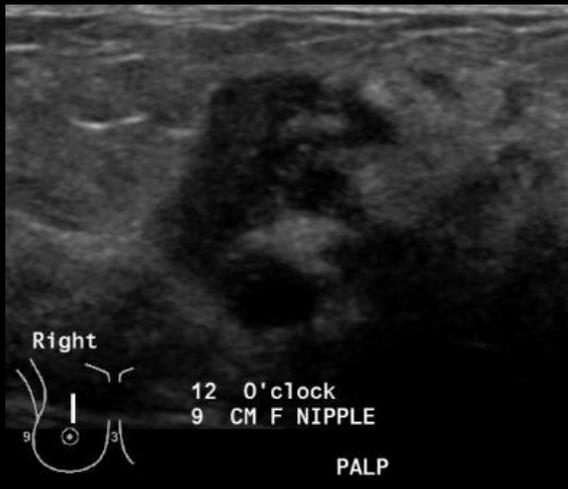
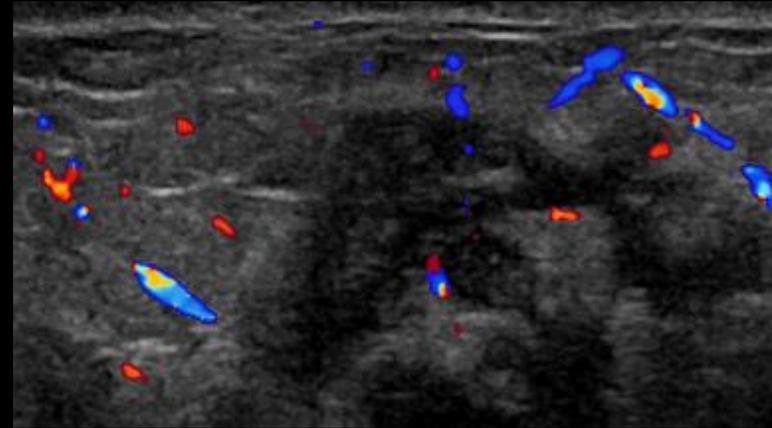
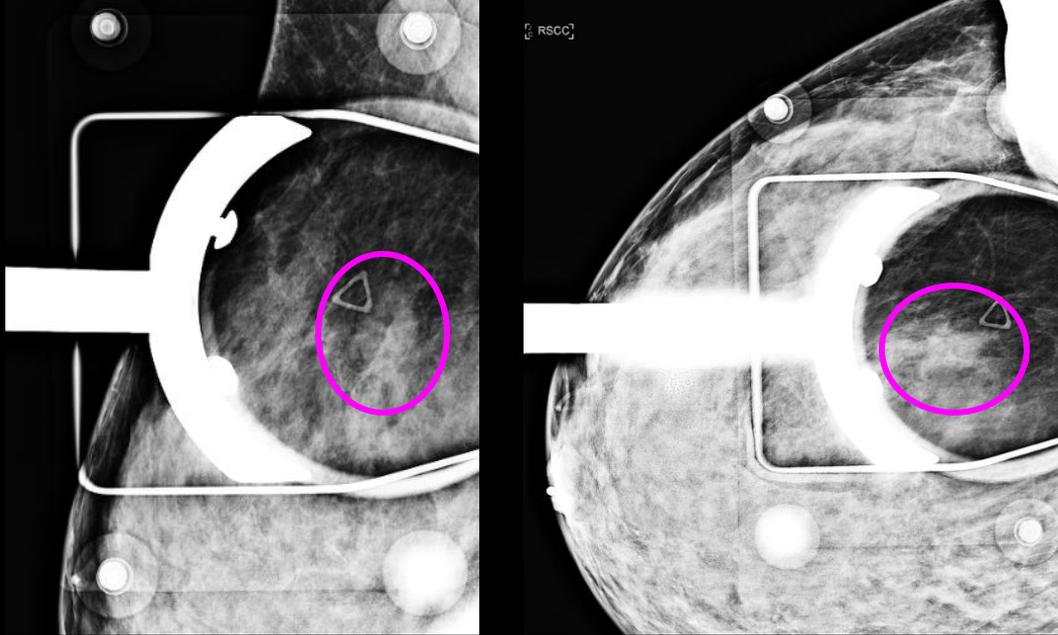
- Idiopathic inflammatory condition characterized histologically by formation of noncaseating granulomas and micro-abscesses. Exact etiology is unknown, however an autoimmune mechanism is suspected.
- Mimics inflammatory breast cancer.
- Presents as breast tenderness, discrete mass, skin erythema and warmth, and/or sinus tract formation with drainage.
- Affects women of childbearing age, usually patients with history of recent childbirth or lactation.
- Treatment is expectant management, steroid therapy, or surgical excision.

Imaging Appearances:

- Mammogram
 - Can appear as diffuse asymmetries throughout the breast or as areas of focal asymmetry.
- Ultrasound
 - Characteristically see multiple hypointense tubular masses that are often connecting with each other.
 - Usually no posterior features.
 - Can see surrounding edema and/or skin thickening.
 - Commonly see hypervascularity within the masses and surrounding tissue.
- MRI
 - Can see focal or diffuse asymmetric signal intensity.
 - Low T1 signal and high T2 signal.
 - Usually see enhancement post contrast, which can appear heterogeneous or rim enhancing.

Granulomatous Mastitis

Slide 1/2



28 F presents with palpable abnormality in the right breast :

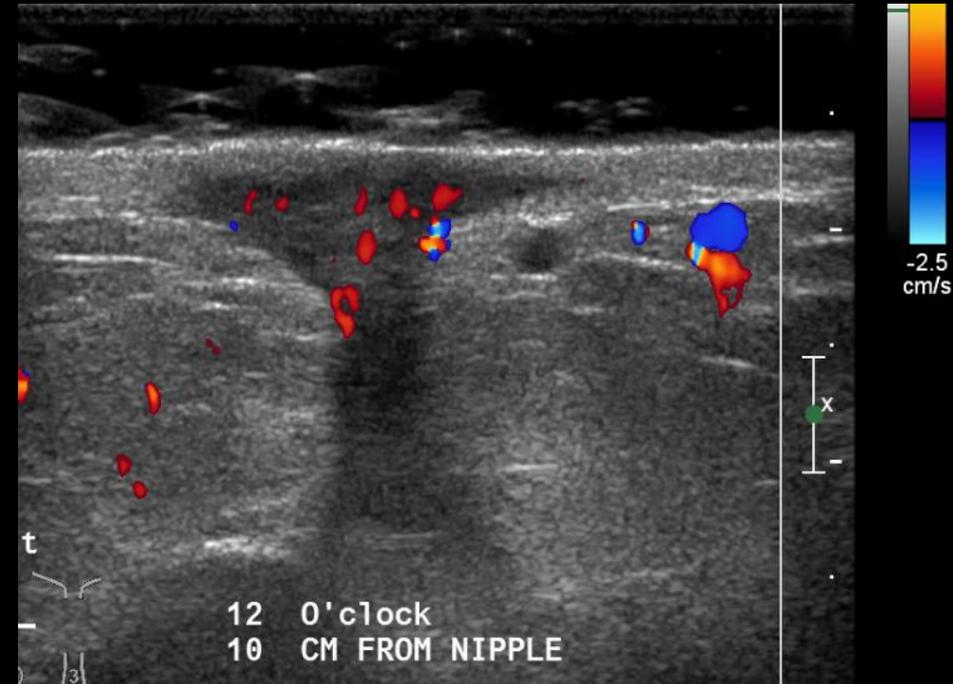
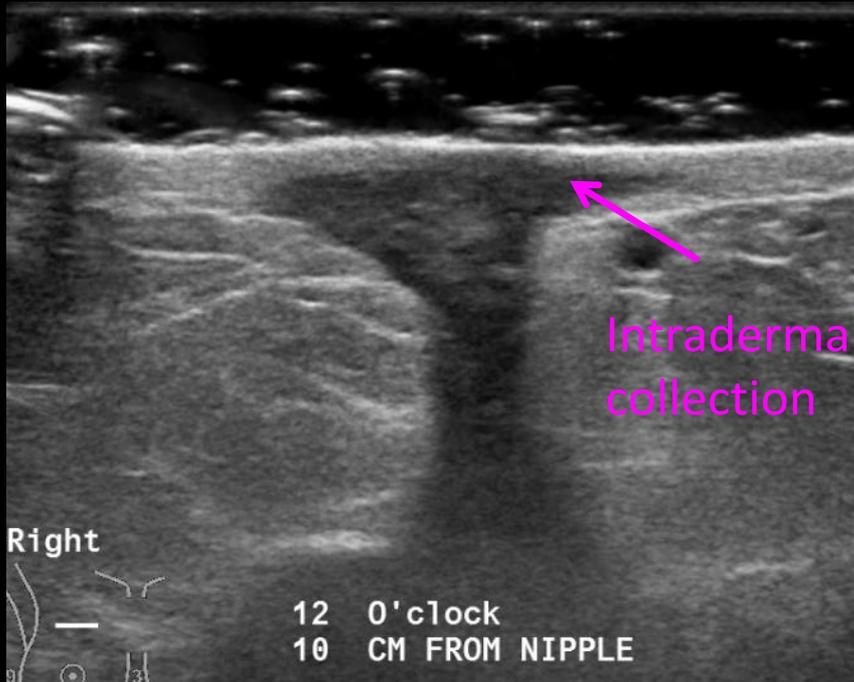
Mammogram: MLO and CC spot compression view demonstrate focal asymmetry in the UOQ at the site of palpable abnormality.

Ultrasound: Complex cyst with solid components at the site of the palpable abnormality, measuring 27 x 18 x 19 mm, with marked internal vascularity on color Doppler imaging.

Pathology: A fine needle aspiration was performed which yielded purulent material with granulomatous inflammation. No malignant cells or microbes were identified. Findings suspicious for possible infection. (Pathology images not shown.)

Granulomatous Mastitis

Slide 2/2



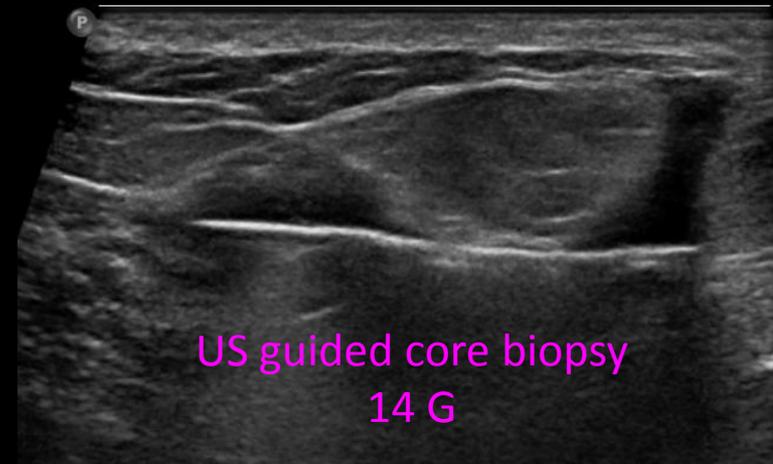
Same 28 F presents for 2 month follow-up:

Ultrasound: 2 months later the patient was reimaged showing a hypoechoic collection at 12 o'clock with an elongated vertical tract communicating with an intradermal collection (at the site of prior aspiration).

Ultrasound Guided Core Biopsy was performed.

Pathology: Benign breast tissue with non-caseating granulomas and associated acute and chronic inflammation. No micro-organisms identified. Findings consistent with granulomatous mastitis. (Images not shown.)

Outcome: This patient underwent expectant management and symptoms resolved in 3 months.



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